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Electrical World

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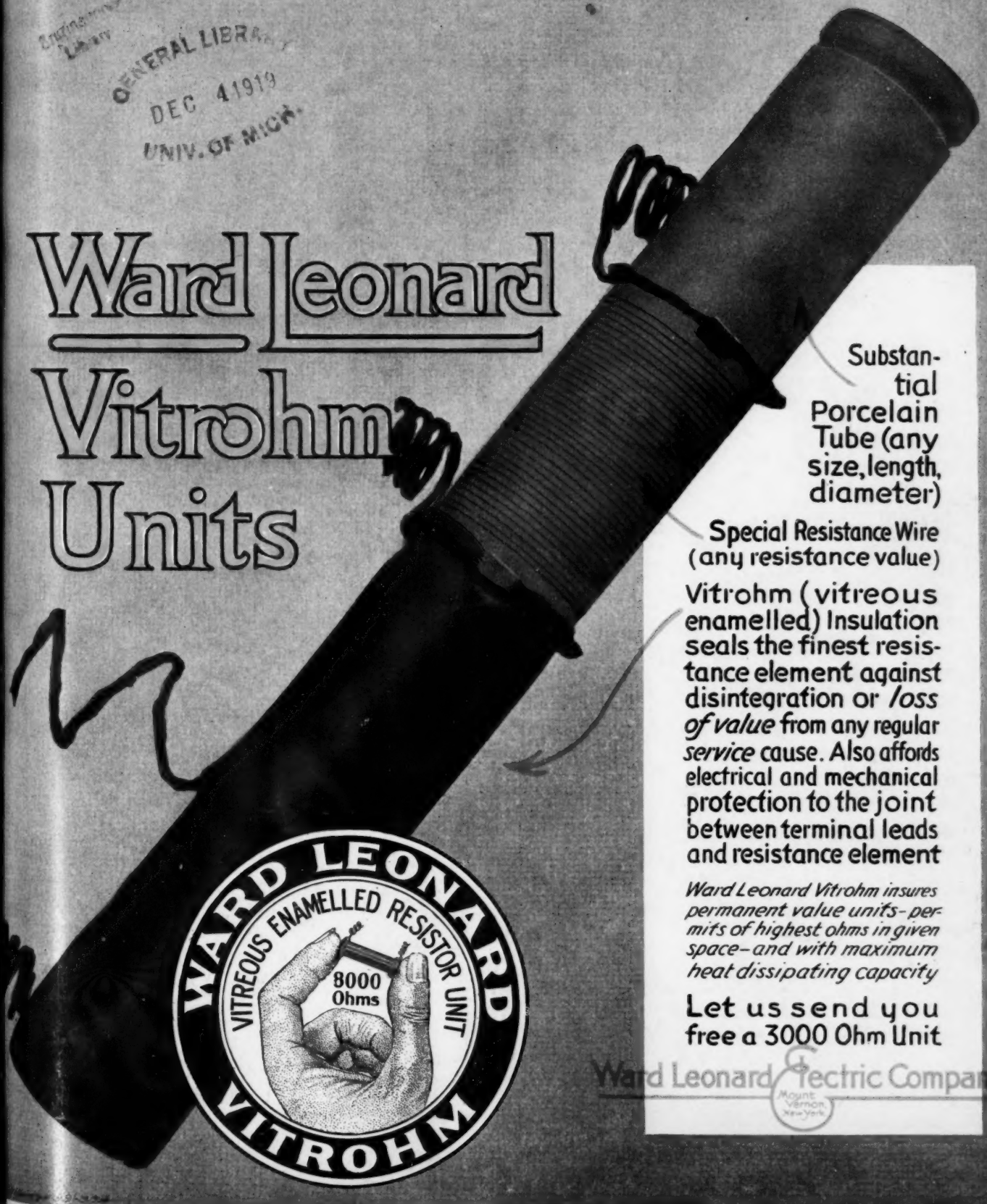

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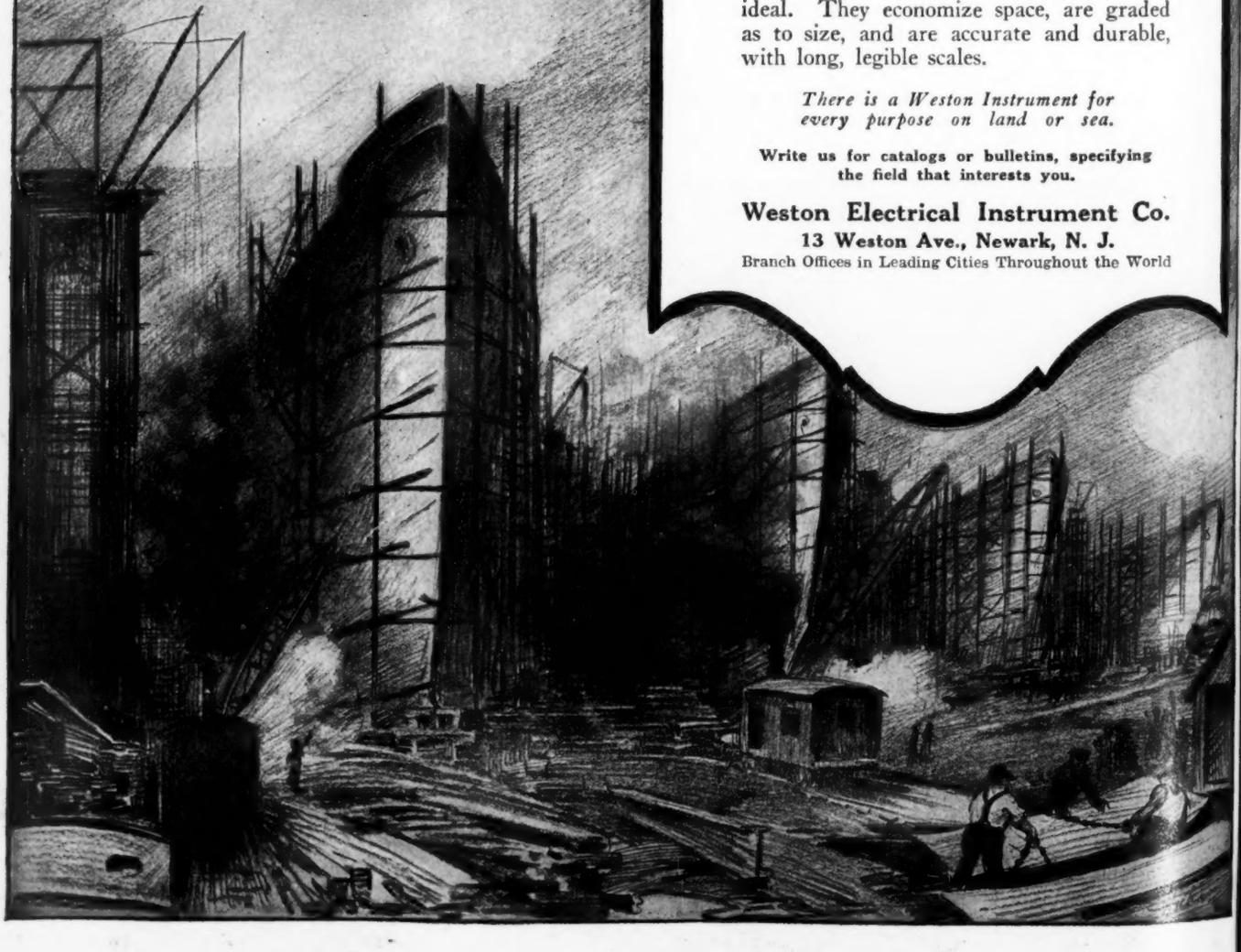

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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Kindred Interests Meet Together

THE grouping of the committee and bureau meetings of the Commercial Section of the National Electric Light Association in Chicago recently proved so beneficial to the association and to the individuals attending that the practice will probably be continued by the administration. The technical committees of the association might well emulate the example of their commercial brothers and hold meetings at one place, to permit members to become acquainted and familiar with the work of kindred committees. The idea has even still greater possibilities. It could be adopted with advantage by the committees of many different organizations which operate along parallel lines. Such organizations in the industry owe it to themselves and to their members to bring about closer co-ordination of their complementary activities.

Service is the word, but it is the spirit of readiness in which it is given that makes it the essential characteristic in central-station policy.

The Commission's Part

IN ONE state legal machinery has been set up whereby the regulating commission is definitely called upon to function in disputes between a public service corporation and its employees. Wisconsin, in a law passed this year, provides for a board of conciliation. In the event of dispute involving a public service corporation and its employees the determination of this board shall be submitted to the Railroad Commission. That commission shall investigate the matter and file its determination confirming or modifying the report. In addition, the law provides a means for reviewing labor costs and rates so as to arrive at a balance between income and outgo, a provision the equity of which is beyond shred of doubt. Another case, different in detail but similar in recognition of the broad principle, is from California. There the Railroad Commission approved the pension plan of the Southern California Edison Company. The commission "will consider the proper cost of the execution of this plan as a proper charge to operating expense." These are two prominent illustrations of the general policy that may be anticipated from a fair public recognition of the facts.

We no longer have or want the old conditions in which the relations of a public utility and its employees could be regarded loosely as the private concern of two parties. Not only in the so-called public utilities but also in many other classes of properties continued operation is accepted to-day as involving a primary "public interest." We are at the point where every industry which touches health and safety—sometimes comfort—of the community has ceased to be merely private. There is, however, a special obligation upon public utilities to render uninterrupted service. The community must have such service; it cannot be without agencies to depend on, so far as human agencies are dependable, for the faithful daily performance of the required tasks. The public has set up as its arbitrator on the great problems of regulation the commissions found now in nearly all states. Thus far commissions have dealt mainly with matters of service and rates, to a lesser extent with financing. They have before them now, in addition to a large work in strengthening the power of companies to maintain adequate service, an opportunity to asssist in upbuilding equitable relations between utilities and their employees.

One of the really useful public documents is that issued by the Board of Gas and Electric Light Commissioners giving the full text of the "New Legislation of Especial Interest to Gas, Electric and Water Companies and Municipalities Owning Lighting Plants." This helps public and companies to understand the changes in public utility relations resulting from new laws.

Short Circuits on Power Systems

EVER since the first Edison incandescent lighting station was built, about the year 1882, electrical engineers and station managers have been busily engaged in accumulating more and more power in their large central stations. More and larger boilers, engines and dynamos have been collected into big city stations, and several such stations in one and the same city have frequently been interconnected electrically on the common conducting network of mains. The results of this continued aggregation have been economically and technically satisfactory, except that, incidentally, a short circuit has come to be regarded as a serious danger.

In the early days of city electric lighting, with a maximum pressure of 250 volts on the system, an accidental short circuit, occurring on the mains at some point remote from the central station, would occasionally give much trouble to eradicate. It became recognized as bad engineering practice to connect the mains to the network through fuses, because these were apt to melt without sufficient justification, and so to extinguish the lamps along a street, to the serious detriment of the service. Consequently, with all the conducting network solidly

connected and with a distant short circuit on the mains of fairly high resistance, it might be very difficult to cut off the defective section promptly. Occasionally a power house might be called upon to bring all its generators to bear upon the short-circuit load for a number of minutes, before sufficient energy could be developed in the short to burn it off. When storage batteries came to be introduced, floating on the system, they often helped to destroy a short promptly by throwing automatically a large amount of energy into it with amazing suddenness.

As high-tension alternating-current generators and feeders came into service the situation in regard to accidental shorts in the high-tension system rapidly changed. A very large amount of energy became liberated in the short, which was apt to vanish explosively; but the mechanical shock on the generators, as well as the electric shock on the rest of the system, might be very severe.

R. F. Gooding contributes an article this week upon the calculation of the maximum production of power that "shorts" may initiate. Fortunately, the short circuits cannot last for many cycles because their magnitudes are so great. For instance, the article discusses one somewhat extreme case, where the instantaneous power liberated within a particular plant by a short in or near a generator might reach a total of 1,500,000 kva., or 1500 megavolt-amperes. This power, at unity power factor, continued for one second, would suffice to raise more than four tons of water from room temperature to the boiling point. It is easy thus to recognize the large quantities of energy which a bad short may suddenly release and the correspondingly large destructive effects that may be possible if adequate precautions are not taken.

A man invents a thing or develops a practice which advances the art and the industry. Are we giving full credit to our pioneers, in whatever branch of the field they labor to make electricity the great industry?

Running in Parallel

THE operation of power plants in parallel is familiar enough on a large scale and yet it involves certain critical features which are not ordinarily apparent. By and large, the operation of several coöperating plants on a single system, especially for long-distance transmission, is a comparatively easy proposition rarely leading to trouble. It is only when the unexpected occurs that the limitations of parallel operation are met. E. C. Stone in an important paper presented before the Institute lately takes up some of the practical considerations regarding parallel operation and works out from the discussion important graphical data to meet various requirements. In general terms, if two plants are operating on the same system in parallel, the line between them must have carrying capacity enough to transmit the necessary maximum load and also synchronizing power enough to keep the machines pulling together. Substantially this synchronizing power is a maximum when the reactance equals the resistance as respects the connecting conducting system, including the generators themselves.

Granted adequate synchronizing power to permit the interchange of sufficient energy, the division of load between two plants may be made so that the division of wattless current may be in proportion to the real energy transmitted, in which case the voltage at the buses will differ with the load or may be so adjusted that the voltages on the two buses will be constant. The latter is the more usual condition, but may often involve heavy call for wattless current to maintain this uniformity. Occasionally where there is spare capacity most of the wattless output may with advantage be thrown on one station. At times of light load maintaining the same bus voltages at both stations may cause the wattless cross-current between them to increase to a somewhat serious amount, and wherever this type of regulation is attempted on the system as a whole it is necessary to keep down cross-current to an amount that will not either strain the current capacity of any of the machines or compel the use of additional capacity from machines otherwise not needed.

As a general method of keeping down the wattless kva., Mr. Stone investigates the advantage which may be gained by varying the voltage according to varying load through cutting in reactance at light loads, by the use of taps on the line transformers, or, where several tie lines are concerned, by cutting out part of them with decreasing load. The problem, as actually worked out, is a somewhat intricate one, presenting, however, several conspicuous salient features. One of the prominent facts is the general advantage of high voltage per mile of line, especially in the case where synchronous condensers are in use for regulation. Up to a certain point fairly high line reactance proves advantageous, but the best value of reactance cannot remain the same under working conditions of load variation; hence Mr. Stone's recommendation regarding the insertion of the station-limiting reactances in the line or changing the number of lines in service.

Under widely varying loads the best conditions of transmission with respect to wattless kva. required on the system must be met by varying, at times somewhat radically, the constants of the combined generating and transmitting system; otherwise there is likely to be a serious strain on the kva. capacity of the synchronous apparatus frequently, which really implies an increase in the cost of transmission that may sometimes rise to a serious amount. Mr. Stone's curves worked out for certain specific cases show very well the treatment which must be applied in the comparatively simple case of two coördinated stations to take care of the system under given variations of load.

In the actual working through of a good many practical cases in feeding a widely extended network still other factors enter which we hope Mr. Stone, with the present experience behind him, will evaluate for the benefit of the profession. Broadly, the most difficult problem with which to deal in big transmission systems is the amount and nature of the wandering of the load. On this very few data are at hand. One of the characteristic advantages of a widely spread distribution is the gain in capacity resulting from diversity factor. This implies shifting of the load in amount, with corresponding changes in the amount and location of the active impedances and reactances, and therewith, of course, wide variation in the call for wattless kva. from and at different points. We earnestly hope that Mr. Stone or some other skillful investigator will go over some fairly large network to determine the actual effects of wandering load with respect to the conditions of load dispatching.

Calculating Short Circuits on Power Systems—I

A Scheme for Calculating Short-Circuit Current and Kva. in Large Power Systems Is Worked Out—The Selection of Circuit Breakers and the Design of Busbar Supports Depend Upon These Calculations

BY R. F. GOODING

IN THE early days of power stations, when a capacity of 10,000 kva. to 20,000 kva. in one station was considered extraordinary, the question of short circuits and their attendant consequences, while important, could hardly be termed vital. An oil circuit breaker that could carry its rated current could open up any short that might occur on the system, and the terms "arc rupturing capacity," "breaking capacity," etc., were unknown. However, instead of 10,000 kva. to 20,000 kva. stations, one now finds single units of that size becoming very common and sees turbo-generators built for 50,000 kva. and 70,000 kva. capacity. For stations of 100,000 kva. to 200,000 kva. capacity the question of short circuits is now extremely vital—in fact, it is one of the most important questions of the present day.

An operating company wishing to run two or three such stations in parallel must make a detailed study of each station and determine its short-circuit possibilities, first when operating alone and then when operating in parallel with the other stations on the system. Calculations must be made to determine just what amount of power will be developed in case of trouble and where the greatest concentration of energy will be, and steps must be taken to limit this energy to the possibilities of the switching equipment handling it. This article will attempt to show in a general way the method of obtaining such values as will enable one to determine the adequacy of design of his entire system for mechanically and electrically controlling these short circuits.

It is assumed that all short circuits are three-phase symmetrical shorts. (All traces of dissymmetry will probably disappear before any circuit breaker can open, so that the above assumption, at least so far as circuit breakers are concerned, is permissible.) Let it also be assumed that, owing to the number of generators on the system, the amount of reactance resident in cables, machines, lines, etc., the generators will be able to sustain full voltage on the bus even in case of a dead short circuit. By the time a breaker opens—0.2 second to 0.3 second—the short-circuit current will decrease, say to 50 per cent of its original value. However, this fact will be ignored for the present, and the values given will be maximum instantaneous values for three-phase

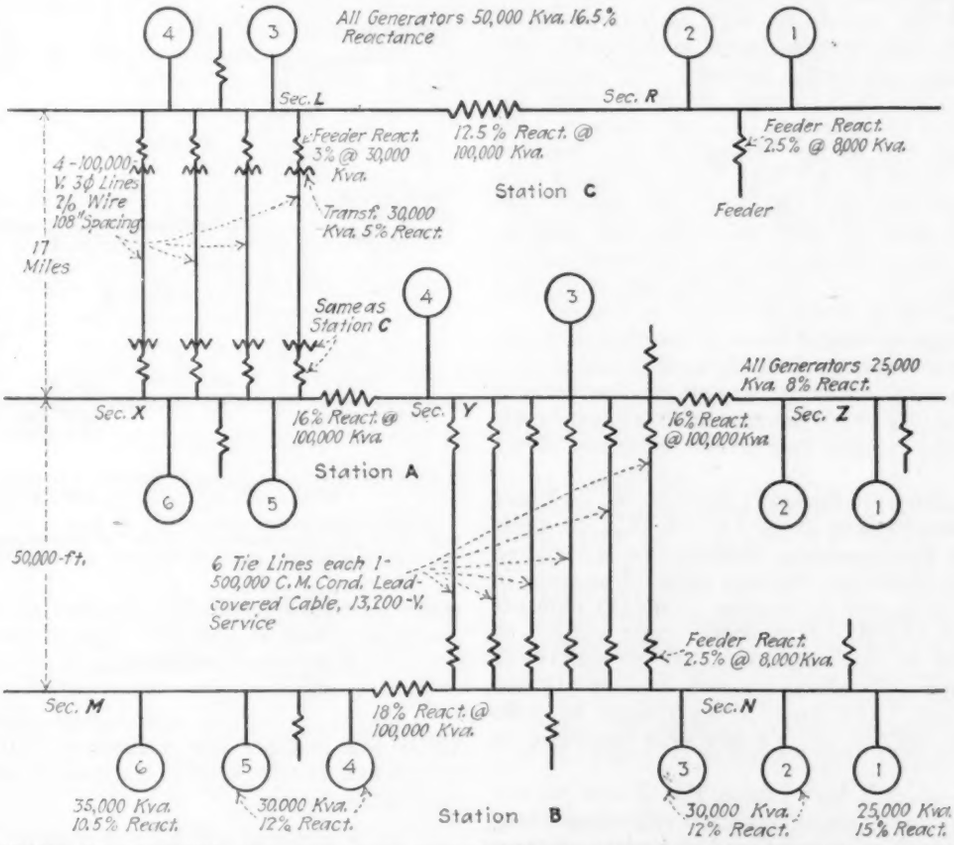

All Generators 50,000 Kva. 16.5% Reactance
Sec. L
Sec. R
Feeder React. 3% @ 30,000 Kva.
12.5% React. @ 100,000 Kva.
Feeder React. 2.5% @ 8,000 Kva.
Station C
Feeder
4 - 100,000 V. 3φ Lines 2/0 Wire 108" Spacing
17 Miles
Transf. 30,000 Kva. 5% React.
Same as Station C
All Generators 25,000 Kva. 8% React.
Sec. X
Sec. Y
Sec. Z
16% React. @ 100,000 Kva.
16% React. @ 100,000 Kva.
Station A
50,000-ft.
6 Tie Lines each 1-500,000 C.M. Cond. Lead-covered Cable, 13,200-V. Service
Feeder React. 2.5% @ 8,000 Kva.
Sec. M
Sec. N
18% React. @ 100,000 Kva.
35,000 Kva. 10.5% React.
30,000 Kva. 12% React.
Station B
30,000 Kva. 12% React.
25,000 Kva. 15% React.

FIG. 1—LAYOUT OF STATIONS AND THE LINES UNDER INVESTIGATION FOR SHORT-CIRCUIT POSSIBILITIES.

symmetrical short circuits. In making these calculations we shall consider the reactance only of generators, cables, etc., and no attention will be given to resistance and capacity.

Fig. 1 shows a system such as we have just outlined. Equipment in each station is as follows:

Specification of Plants to Be Considered.—Station "A."—Six 25,000-kva., 13,200-volt, three-phase turbo-generators, each having an inherent reactance of 8 per cent at full load. The bus is divided into three sections, two machines per section; bus-sectionalizing reactance of 16 per cent at 100,000 kva.

Station "B."—One 25,000-kva., 13,200-volt, three-phase turbo-generator, 15 per cent reactance; four 30,000-kva., 13,200-volt, three-phase turbo-generators, 12 per cent reactance; one 35,000-kva., 13,200-volt, three-phase turbo-generator, 10.5 per cent reactance. Between generators No. 3 and No. 4 there is a bus-sectionalizing reactance of 18 per cent at 100,000 kva.

Station "C."—Four 50,000-kva., 13,200-volt, three-phase turbo-generators, 16.5 per cent reactance. Between machines No. 2 and No. 3 there is a bus reactance of 12.5 per cent at 100,000 kva.

Connections Between Stations "A" and "B."—Between "A" and "B" are six tie lines, each consisting of one 500,000-circ. mil three-conductor lead-covered cable 50,000 ft. (15,200 m.) long. Assuming that conductors in this cable are 1¼ in. (3.2 cm.) center to center, the reactance is found to be 0.0325 ohm per 1000 ft. (300 m.). (See page 236 of the "Handbook on Overhead Construction," N. E. L. A.) 8000 kva. at 13,200 volts would give approximately 350 amp. per phase. 350 amp. × 0.0325 ohm = 11.38 volts drop per 1000 ft. For 50,000 ft., 50 × 11.38 = 569 volts reactive drop. 569 ÷ 7620 = 7.46 per cent, say 7.5 per cent, total reactance for 50,000 ft. (7620 is voltage to neutral).

On every outgoing feeder there is inserted a feeder reactance 2.5 per cent at 8000 kva. at each station. This makes the total reactance of each tie line between Stations "A" and "B" 12.5 per cent at 8000 kva. (cable reactance 7.5 per cent plus two feeder reactances of 2.5 per cent each).

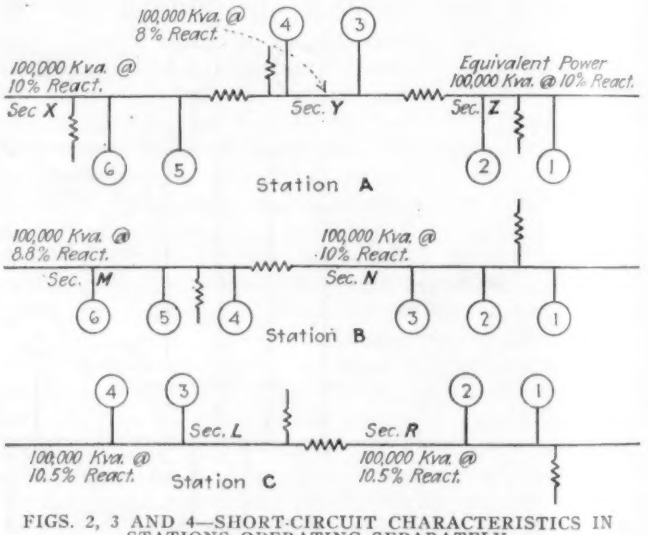
Connections Between Stations "A" and "C."—There are four high-tension lines from "A" to "C," 17 miles (27 km.), each line consisting of three No. 2/0 wires, 108 in. (4.57 m.) spacing, 100,000 volts. Reactance in ohms, No. 2/0 wire, 108 in. spacing = 0.1511 ohm per 1000 ft. (N. E. L. A. "Handbook," page 236). 17 miles = 89,760 ft., say 90,000 ft. 90 × 0.1511 = 13.596 ohms, say 13.6 ohms. 30,000 kva. at 100,000 volts = 175 amp. 175 amp. × 13.6 ohms = 2380 volts. 2380 ÷ 58,000 = 4.1 per cent reactance at 30,000 kva.

At each end of each high-tension line is one 30,000-kva. transformer bank, 100,000/13,200-volt, three-phase, with a reactance of 5 per cent and a feeder reactance of 3 per cent at 30,000 kva. This gives these percentages for the total reactance of each high-tension line: Reactance of line, 4.1; reactance of two transformer banks, 10; reactance of two feeder reactances, 6; total, 20.1 per cent. Say 20 per cent at 30,000 kva.

Analysis for Separate Stations

At the outset the different stations must be brought to a common basis, considering not the kva. rating alone but the short-circuit possibilities of each station. For instance, a 25,000-kva. generator with 10 per cent reactance will at time of short circuit develop 250,000 kva.; a 50,000-kva. machine with 20 per cent reactance would develop the same amount, and a 100,000-kva. generator (if such a thing were possible) with 40 per cent reactance would give the same results. Therefore a 25,000-kva generator with 10 per cent reactance, so far as short circuits are concerned, is the equivalent of 100,000 kva. at 40 per cent reactance. For facility of comparison, then, each station is reduced to terms of 100,000 kva. with its equivalent reactance. Diagrams will be made for each station, and each station of the bus will be marked with its proper value; *e.g.*, 100,000 kva. at 8 per cent reactance, etc. It should be borne in mind that for series circuits the kva. in the different parts must be the same if reactances are added, and that in parallel circuits the equivalent reactances must be the same if kvas. are added.

Station "A."—If there were no bus reactances in this station and a short circuit occurred on the bus, the



FIGS. 2, 3 AND 4—SHORT-CIRCUIT CHARACTERISTICS IN STATIONS OPERATING SEPARATELY.

Short circuit in bus section "X" at Station "A" is marked 100,000 kva. at 10 per cent reactance. Thus the instantaneous apparent power and current developed would be 1,000,000 kva. and 43,800 amp.

power developed would be 1,875,000 arc kva. = 82,250 arc amp. This is obtained from six 25,000-kva. machines at 8 per cent reactance.

	Kva.	Per Cent Reactance
150,000 kva. at 8 per cent reactance =	100,000	5.33

100,000 kva. at 5.33 per cent reactance = 1,875,000 arc kva., or 82,250 arc amp.

With a sectionalized bus, as shown in Fig. 1, but using a bus reactance of 5 per cent at 100,000 kva., we would proceed as follows: Generators Nos. 1 and 2 would give 50,000 kva. at 8 per cent reactance on short circuit. Any power from Section "Z" to Section "Y" must pass through the bus reactance (assume for this case 5 per cent at 100,000 kva.), so this reactance should be added to that of the generators, or rather to the equivalent reactance of generators Nos. 1 and 2. This would be:

	Kva.	Per Cent Reactance
Generators 1, 2 = 50,000 kva. at 8 per cent reactance	= 100,000	16
Bus reactance	= 100,000	5
Total power from Section "Z" to Section "Y"	= 100,000	21
	= 38,000	8

Power from Section "X" to Section "Y" same as from Section "Z" to Section "Y." The total power on Section "Y" will then be:

	Kva.	Per Cent Reactance
Power from Section "Z"	= 38,000	8
Power from Generators 3, 4	= 50,000	8
Power from Section "X"	= 38,000	8
Total power on Section "Y"	= 126,000	8
	= 100,000	6.35

100,000 kva. at 6.35 per cent reactance = 1,575,000 arc kva., or 69,000 arc amp.

A reduction from 82,250 amp. to 69,000 amp. not being sufficient, we will now consider the reactance shown in Fig. 1, namely, 100,000 kva. at 16 per cent.

Power on Section "Y."—

	Kva.	Per Cent Reactance
Generators 1, 2 = 50,000 kva. at 8 per cent reactance	= 100,000	16
Bus reactance	= 100,000	16
Power from Section "Z" to Section "Y"	= 100,000	32
	= 25,000	8
Generators 3, 4	= 50,000	8
Power from Section "X" to Section "Y"	= 25,000	8
Total power on Section "Y"	= 100,000	8

100,000 kva. at 8 per cent reaction = 1,250,000 arc kva., or 55,000 arc amp.

Power on Section "X."— In case of short at any point in Section "X" the power from Sections "Z," "Y" and "X" is computed as follows:

	Kva.	Per Cent Reactance
Power from Section "Z" to Section "Y"	= 25,000	8
Generators 3, 4	= 50,000	8
	= 75,000	8
	= 100,000	10.67
Bus reactance	= 100,000	16
Power from Section "Z" plus "Y" to "X"	= 100,000	26.67
	= 30,000	8
Power from Section "Z" plus "Y" to "X"	= 30,000	8
Generators 5, 6	= 50,000	8
Total power on Section "X"	= 80,000	8
	= 100,000	10

100,000 kva. at 10 per cent reactance = 1,000,000 arc kva., or 43,800 arc. amp.

Power on Section "Z."—It will at once be evident that the conditions on Section "Z" will be exactly the same as on Section "X," so no calculations need be made for it. However, as will be shown later, this condition obtains only when Station "A" is operating alone.

Short Circuit on Radial Feeders

Feeder reactances 2.5 per cent at 8000 kva.

Section "Y."—

	Kva.	Per Cent Reactance
Power on bus	= 100,000	8
Feeder reactance, 8000 kva. at 2.5 per cent	= 100,000	31.25
Power on feeder	= 100,000	39.25

100,000 kva. at 39.25 per cent reactance, say 39.3%.

100,000 kva. at 39.3 per cent reactance = 254,000 arc kva., or 11,100 arc amp.

Radial Feeder-Section "X" or Section "Z."—

	Kva.	Per Cent Reactance
Power on bus section "X" or "Z"	= 100,000	10
Feeder reactance, 8,000 kva. at 2.5 per cent	= 100,000	31.25
Power on feeder	= 100,000	41.25
	Say 100,000	41.3

100,000 kva. at 41.3 per cent = 242,000 arc kva., or 10,600 arc amp.

Short in Generator.—It is common practice nowadays to have differential protection for generators. Relays, etc., are so arranged that in case of internal trouble in the machine the generator oil circuit breaker will be tripped. This means, then, that the generator breaker may be called upon to rupture all of the current that the other generators can "pump" into its faulty windings. To find what this value is it is necessary only to subtract the short-circuit current of the machine itself from the total for that particular bus section.

For Station "A" a machine of 25,000 kva. at 8 per cent reactance would have a short-circuit value of 312,000 arc kva. = 13,200 arc amp.

Short in Machine, Section "Y."—

	Arc Amp.
Bus short circuit, Section "Y"	= 55,000
Generator short circuit	= 13,200
Short in generator	= 41,800

Sections "X" and "Y."—

	Arc Amp.
Bus short circuit, Section "X" or "Z"	= 43,800
Generator short circuit	= 13,200
Short in generator	= 30,600

Section No. 2 shows equivalent power of Station "A" when operating alone; 100,000 kva. at 10 per cent reactance on Section "X" means total power developed at any point in Section "X" in case of short circuit there.

Station "B" Operating Alone.—Before getting the equivalent power on station "B" bus we must first bring the machines themselves to a common basis. As the majority of them have 12 per cent reactance, we can save time by reducing all of them to terms of 12 per cent reactance. For section "M" they would be:

	Kva.	Per Cent Reactance
No. 6 generator 35,000 kva. at 10.5 per cent reactance	= 40,000	12
No. 5 generator	= 30,000	12
No. 4 generator	= 30,000	12
Total power Section "M" alone	= 100,000	12
For Section "N":		
No. 1 generator, 25,000 kva. at 15 per cent resistance	= 20,000	12
No. 2 generator	= 30,000	12
No. 3 generator	= 30,000	12
Total power section "N" alone	= 80,000	12

If there were no bus reactance, the total power on the bus would be the sum of Section "M" plus Section "N," or 180,000 kva., at 12 per cent reactance. This would give, at short circuit, 1,500,000 arc kva. = 66,000 arc amp.

With a bus reactance as shown (18 per cent at 100,000 kva.), the conditions will be somewhat different.

Power on Section "M."—

	Kva.	Per Cent Reactance
Power on Section "N" 80,000 kva. at 12 per cent reactance	= 100,000	15
Bus reactance	= 100,000	18
Power from Section "N" to Section "M"	= 100,000	33
	= 36,300	12
Generators 4, 5, 6	= 100,000	12
Total power on Section "M"	= 136,300	12
	= 100,000	8.8

100,000 kva at 8.8 per cent reactance = 1,140,000 arc kva., or 50,000 arc amp.

Power on Section "N."—

	Kva.	Per Cent Reactance
Power from generators 4, 5, 6	= 100,000	12
Bus reactance	= 100,000	18
Power from Section "M" to Section "N"	= 100,000	30
	= 40,000	12
Power from generators 1, 2, 3	= 80,000	12
Total power on Section "N"	= 120,000	12
	= 100,000	10

100,000 kva. at 10 per cent reactance = 1,000,000 arc kva., or 44,000 arc amp.

Radial Feeder—Section "M."—

	Kva.	Per Cent Reactance
Power on Bus Section "M"	= 100,000	8.8
Feeder reactance, 8000 kva. at 2.5 per cent reactance	= 100,000	31.25
Power on feeder	= 100,000	40.05

100,000 kva. at (say) 40 per cent reactance = 250,000 arc kva., or 11,000 arc amp.

Radial Feeder—Section "N."—

Power on Bus Section "N"	= 100,000	10
Feeder reactance	= 100,000	10
Power on feeder	= 100,000	41.25

100,000 kva. at 41.25 per cent reactance = 242,000 arc kva., or 10,000 arc amp.

Short in Machine.—In case one wants to know the rupturing duty placed on a generator breaker, owing to short circuit in the generator windings, one can subtract the short-circuit amperes of the machine itself from the total for that section of the bus. Short-circuit values of generators are as follows:

	Arc Kva.	Arc Amp.
No. 1—25,000 kva. at 15 per cent reactance	= 167,000	= 7,400
No. 2—30,000 kva. at 12 per cent reactance	= 250,000	= 11,000
No. 3—30,000 kva. at 12 per cent reactance	= 250,000	= 11,000
No. 4—30,000 kva. at 12 per cent reactance	= 250,000	= 11,000
No. 5—30,000 kva. at 12 per cent reactance	= 250,000	= 11,000
No. 6—35,000 kva. at 10.5 per cent reactance	= 333,000	= 14,600
Total	=1,500,000	= 66,000

Fig. 3 shows reactance diagram for station "B" operating alone.

Station "C" Alone.—With no bus reactance at station "C," the power on the bus would be 200,000 kva. at 16.5 per cent reactance = 100,000 kva. at 8.25 per cent reactance.

100,000 kva. at 8.25 per cent reactance = 1,210,000 arc kva. = 53,000 arc amp.

With bus reactance as shown (12.5 per cent at 100,000 kva.) the values would be as follows:

Short Circuit on Section "L."—

	Kva.	Per Cent Reactance
Generators 1, 2	= 100,000	16.5
Bus reactance	= 100,000	12.5
Power from Section "R" to Section "L"	= 100,000	29
	= 57,000	16.5
Generators 3, 4	= 100,000	16.5
Total power on Section "L"	= 157,000	16.5
	= 100,000	10.5

100,000 kva. at 10.5 per cent reactance = 952,000 arc kva., or 41,800 arc amp.

Short Circuit on Section "R."—Obviously, this value would be exactly the same as for Section "L." This statement, however, is true *only* when Station "C" is operating alone.

Radial Feeder—Section "L" or "R."—

	Kva.	Per Cent Reactance
Power on bus	= 100,000	10.5
Feeder reactance, 8000 kva., at 2.5 per cent reactance	= 100,000	31.25
Power on feeder	= 100,000	41.75

100,000 kva. at 41.75 per cent reactance = 239,000 arc kva., or 10,500 arc amp.

Short in Machine.—Short-circuit current of generator:

50,000 kva. at 16.5 per cent reactance = 303,000 arc kva., or 13,300 arc amp. Subtracting 13,300 from 41,800 gives 28,500 arc amp. in case of generator trouble.

Fig. 4 shows reactance diagram for Station "C" when operating alone.

The calculations for all stations in parallel will be completed in an early issue of the ELECTRICAL WORLD.

THE problem of labor is one of the most serious that are before us. Its solution will lie along lines that unite a knowledge of human nature with a realization of the rights of the worker to be adequately compensated and to be in all respects recognized and treated as an honorable and essential part of the country's industrial life. The business life of the world is in a state of extraordinary readjustment. To-day, as in all times of unrest, we are beset by a multitude of the hasty, the unthinking or the evil-minded with panaceas for the relief of conditions. Their remedies overlook the fact that the only effective cure will come through the age-tested formula of hard work, frugal living, economical government and co-operation.—*George B. Cortelyou.*

The Electrical Market in Italy

Hydroelectric Equipment Offers the Greatest Outlet for Exports to That Country, Where Electrical Energy Is Very Generally Used in Industrial Plants

BY O. M. SMART
Trade Commissioner, Bureau of Foreign and Domestic Commerce, Washington, D. C.

WHAT is probably the biggest opportunity for American electrical goods in Italy lies in the field of hydroelectric power plants, particularly in the south, which is relatively undeveloped. On account of the scarcity of good coal in Italy the demand for hydroelectric power has never been equal to the supply, although Italy's water power is already highly developed. The impossibility of getting coal during the war has brought home very forcibly the necessity of further development, so that it has become a national issue.

The possibility of doing business in this field depends entirely on the investment of capital. Investment of American capital would have to be made in combination with Italian interests rather than by assuming the entire direction and control of the undertaking. It is a question of promotion, with the possibility that ultimately the entire capital would be absorbed by Italian interests.

The large power companies are closely affiliated and have divided up the entire territory of Italy between them. A list of the larger companies taken from the *Bulletin* of the American Chamber of Commerce for Italy is given below. All of these companies are in good condition financially and have their programs of expansion. The companies which have not distributed dividends are those with the steam plants. In pre-war years these companies were very prosperous. The listed companies are:

Società Elettrica di Ponente Ing. R. Negri, Savona.
Società Generale Italiana Edison di Elettricità, Milan.
Società Adriatica di Elettricità, Venice.
Società Elettrica Ligure, Toscana, Livorno.
Società Meridionale di Elettricità, Naples.
Società Imprese Elettriche Conti, Milan.
Società Anglo-Romana per Illuminazione, Rome.
Società Generale Elettrica della Silicia, Milan.
Società Generale Elettrica Adamello, Milan.
Società Anonima Alta Italia, Milan.
Società Lombarda per Distribuzione di Energia Elettrica, Milan.
Società Anonima Elettrica Bresciana, Brescia.
Società Dinamo, Milan.
Officinà Elettrica, Genovesi, Genoa.
Società Nazionale per lo Sviluppo delle Imprese Elettriche, Milan.

Società Generale per l'Illuminazione, Naples.
Società Forze Idrauliche del Veneto, Venice.
Società Idroelettricà Piemonte, Turin.
Unione Esercizi Elettrici, Milan.
Società Idroelettricà Ligure, Milan.
Società Elettrica Mineraria Valdarno, Florence.
Società Forze Idrauliche Alto Po, Milan.
Società Emiliana Esercizi Elettrici, Parma.
Società Toscana per Imprese Elettriche, Florence.
Società Forze Idrauliche del Moncenisio, Turin.
Società Napolitana per Imprese Elettriche, Naples.
Società Anonima Orobia, Lecco.
Società Catanese di Elettricità, Catania.
Società Varesina Imprese Elettriche, Varese.
Società Bolognese di Elettricità, Bologna.
Società Sicula Imprese Elettriche, Palermo.
Società Bergamasca Elettrica, Bergamo.
Società Comense Alta Volta, Como.
Società Forze Idrauliche di Trezzo d'Adda, Milan.
Società Brioschi per Imprese Elettriche, Milan.
Società Elettrica del Caffaro.

Before the war the Germans practically controlled the electrical industry of Italy and the largest part of her electrical goods came from Germany. The Germans exercised their control through the banks and with a small amount of capital compared with that invested by the British and French. The present highly centralized financial régime is mainly due to the Germans.

Since the war electrical manufacturing, in common with the iron and steel industry, has received a tremendous impulse. If present plans carry out, eventually Italy will be able to produce all her own electrical material with the exception of some special lines for which there would not be a large enough market. There is a strong movement to patronize home trade, and the governmental policy is to protect domestic industry. Until recently it has been necessary to secure a permit from the government for each importation. These permits were not issued if, in the opinion of the government, the goods could be obtained in Italy. However, word has just been received that these restrictions have been removed on electrical goods with the exception of incandescent lamps, on which a government monopoly has been created.

The principal material wanted now for hydroelectric development consists of large generators and transformers and steel pipe for penstocks. There are a few Italian concerns, mostly having foreign connection, which could build this material, but they are handicapped by lack of raw material. In any event the business would be certain to go to the suppliers of the capital.

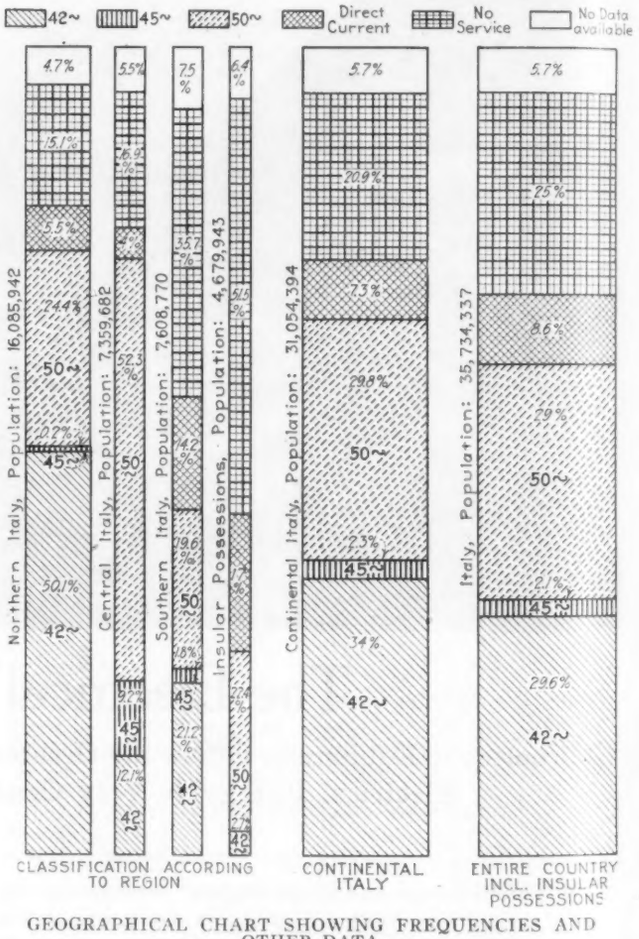
There is an opportunity for aluminum-cell lightning arresters as these are not made in Italy. However, this type of lightning arrester is not in as wide favor as in the United States. American high-tension insulators are in demand, as the Italian factories have not yet succeeded in making equally reliable insulators.

Waterwheels are made in Italy, and there is at least one manufacturer with a world-wide reputation. Italy is also in a position to supply the switchboards and types of instruments, such as synchronizing indicators and frequency indicators, which are not made in Italy.

Before the war there was practically no Italian watt-hour meter manufacture, but during the war the production has rapidly increased, and although a great many American meters were imported during the war, the demand will decrease.

Among other lines of material not now made in Italy or not made in sufficient quantities are incandescent lamps, telephones, self-starting single-phase motors, constant-current transformers, and carbon electrodes for electric furnaces.

The most common generator voltage is 5000 to 6000, although a generating voltage of 15,000 has been successfully used. The distribution in cities is always underground. Three-conductor armored cable is simply laid in a wooden trough and an insulating compound poured in. There is a very great lack of standardization in lighting voltages. These voltages, as well as frequencies, etc., are given for all the cities of Italy in a publication of the Associazione Elettrotecnica Italiana under the heading "Dati Elettrotecnici."



GEOGRAPHICAL CHART SHOWING FREQUENCIES AND OTHER DATA.

The principal frequencies as shown in the graphical analysis by population are 42, 45 and 50 cycles.

Railroad electrification has already had a considerable degree of development in Italy. The system most generally employed by the State railroads is three-phase, 16-cycle, 3000 volts, and this has been found very satisfactory from an operating standpoint. The line from Genoa to Turin and Mondane has already been partly electrified, and work is now in progress to complete this line, which it is planned to finish in two years. The present plan of the government is to continue with the electrification of all the important trunk lines at the rate of about 4000 kw. per year. There are a large number of so-called steam tramways, or secondary railroads, many of which are planning for electrification.

On account of the large amount of electric power already developed, the use of electricity is very general throughout the north of Italy. Although the rates for small consumers for illumination purposes at the present time are about the same as in the United States, this is principally due to the fact that there is a very heavy tax on electricity used for illumination purposes, amounting to about 50 per cent of the total bill. The use of electricity is very general in industrial plants. Only about 10 per cent of the total output is used for illumination. The rates for industrial plants are the subject of special contracts and are usually quite low, industrial companies frequently owning large amounts of stock in the power companies.

Development in New Hampshire and Vermont

Locations of Electric Generating Stations, Substations and Transmission Lines in These New England States—Possible Connections with Connecticut Systems

THE development of electric power transmission lines in New Hampshire and Vermont has gone forward steadily during the last few years. Only a short while ago the principal industrial regions of these states were served mainly by local power systems and separated from other systems by relatively wide areas in which only small local plants existed. At present interconnections have been effected between several of the principal systems, and the tendency toward further physical unification seems strong.

The present relations of these power systems are brought out in a map just issued in preliminary form by the United States Geological Survey, which shows the location of generating stations, substations and primary transmission lines in these states. The map is issued on a scale of 8 miles to the inch and is presented in simplified form in connection with this article. It shows six principal regions in which there are transmission systems.

Transmission Systems of New Hampshire

In the Portsmouth-Dover district of southern New Hampshire the lines are principally those of the Rockingham County Light & Power Company. In the Merrimac valley the Manchester Traction, Light & Power Company with its subsidiaries forms another long system. The lower Connecticut valley is occupied by a group of companies connected physically with the plant of the New England Power Company at Vernon, the largest hydroelectric plant in this territory. At Rutland centers another plexus of line, extending not only north and south through the Otter Creek valley but westward into eastern New York. In this region the Rutland Railway, Light & Power Company, the Colonial Power & Light Company, the Vermont Marble Company and the Hortonia Power Company are closely interconnected and, through common load dispatching, are essentially a single operating unit. The systems in the Winooski Valley, including the Montpelier and Barre Light & Power Company and the Burlington Light & Power Company, serve the last of the important regions of power supply.

Up to the present the Rockingham County system, serving Portsmouth and vicinity, has not been tied southward to the lines in northeastern Massachusetts, although the company has two substations south of the state line. Quite a gap also remains between the Rockingham County Company's lines and those of the Cumberland County Power & Light Company, serving Portland, Me., and vicinity, and there is a broad area of unoccupied territory between it and the lines in the Merrimac valley on the west.

The isolation of the Merrimac valley has, however, been overcome through the erection by the New England Power Company of a high-tension transmission line northward from Ayer, Mass., to Nashua, N. H. This line, which is operated at 66,000 volts and has a large capacity, now supplies only the Nashua Manufacturing Company, but it will probably lead ultimately to the interchange of energy at Nashua with the Manchester company.

Through an interconnection with the power system of the Boston & Maine Railroad, used for the operation of the electric railway in the Merrimac Valley, a continuous circuit has been formed which reaches westward to Newport and almost closes the gap between the Merrimac and Connecticut valleys. The distance between Newport and Claremont, the nearest points of the two systems, is less than 10 miles (16 km.).

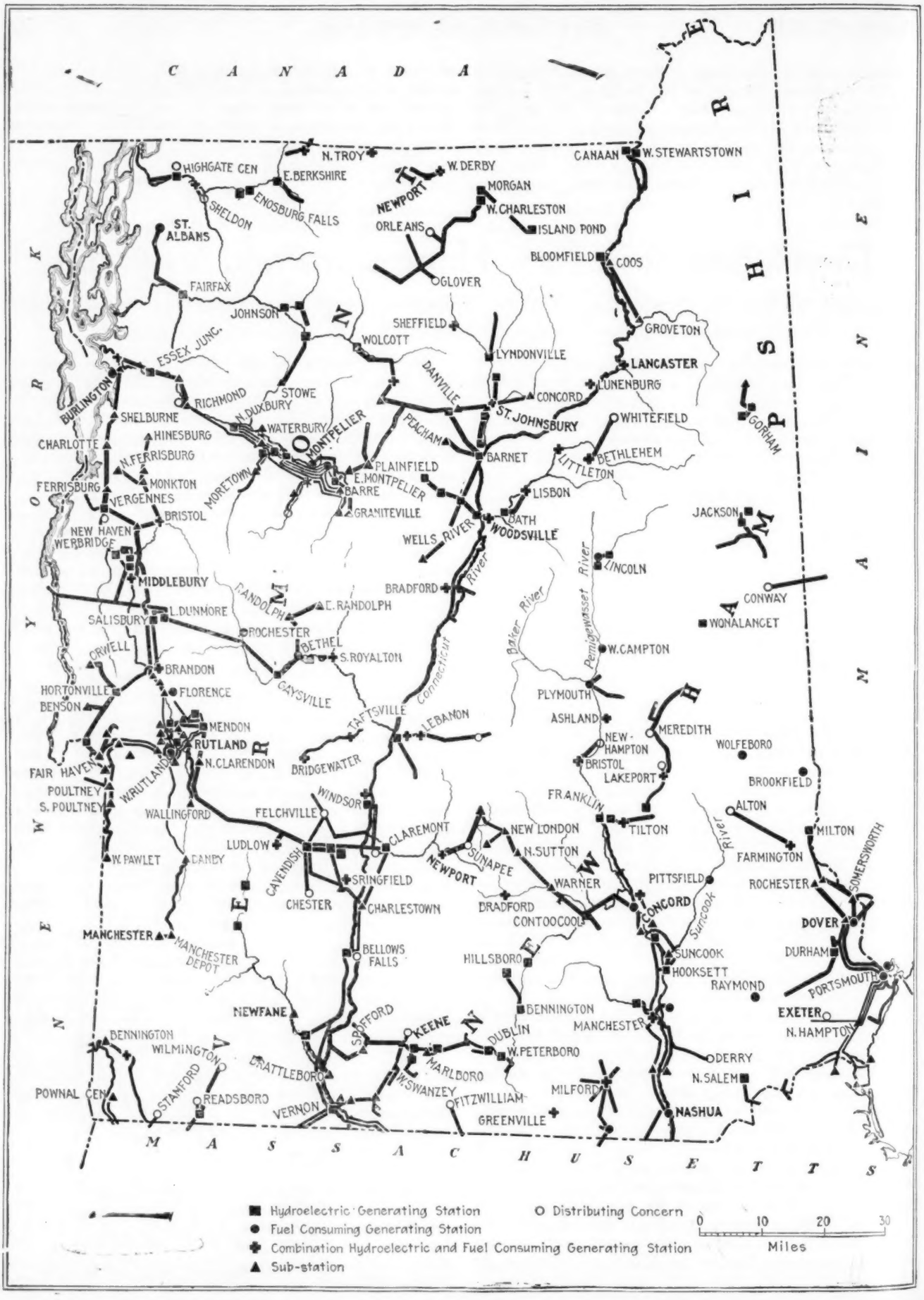
Transmission Systems of Vermont

The lines from the Connecticut valley into Vermont form a northward extension from Massachusetts of the main transmission system of the New England Power Company. A connection has been established at Vernon with the Keene Gas & Electric Company and at Claremont with the Claremont Power Company. Through ties at Cavendish there is also continuous transmission at 44,000 volts from Vernon to the Mendon power house of the Rutland Railway, Light & Power Company. This interconnection is one of the most important in the state as it gives opportunity for the interchange of a large amount of energy between the plants around Rutland and the Connecticut Valley system.

The map indicates that the gap between the lines of the Hortonia Power Company and those of the Burlington company is being bridged by a line from New Haven to Vergennes, thus giving at least a light connection between the Rutland region and the lines in the northern part of the state. The Hortonia Power Company is also connected by a transmission line to the Port Henry Light & Power Company in New York, and the Rutland company reaches into that state. In the extreme north one transmission line crosses the international boundary, extending from Rockford, Vt., to Sutton, Que.

Possible Connections with Connecticut Systems

The upper Connecticut Valley has two systems with rather extensive transmission lines that are not yet interconnected. These are the Twin State Gas & Electric Company (St. Johnsbury Division) and the Eastern Vermont Public Utilities Corporation. The gaps between these systems and that of the Montpelier & Barre Com-



MAP SHOWING ELECTRIC SERVICE DEVELOPMENT OF NEW HAMPSHIRE AND VERMONT

pany are also small, but as these companies use water power almost exclusively, there has not been the same incentive to interconnection that has produced such unions in areas more largely dependent upon fuels.

The Geological Survey is sending to all the power companies affected copies of the preliminary map described above, with the request that the locations of lines and power stations be carefully reviewed. After suggested changes have been received and incorporated a revised edition will be printed for general distribution. The division of power resources of the Geological Survey purposes to accompany the final map with tables showing the characteristics of the various transmission lines and the equipment and ownership of the power stations.

The work in the Geological Survey is under the supervision of A. H. Horton, chief of the division of power resources, and the map was compiled by G. D. Thomas.

CANADA'S COAL SCARCITY STIMULATES WATER POWER

Conserving Fuel by Railway Electrification and Elimination of Isolated Steam Plants Recommended by Fuel Controller

IN THE final report of the Fuel Controller of the Dominion of Canada, C. A. McGrath, describing the activities of his department from its creation in March 1917 until the end of the war, there is presented not only an illuminating review of Canadian fuel problems of the war period but a comprehensive discussion of the conditions controlling the future supply of energy in the provinces.

As typical of Canadian conditions, careful statistics of the use of fuels were compiled for the year 1917. During that year Canada consumed more than 35,000,000 tons of coal, of which 50 per cent was imported from the United States. Of this amount 11,792,550 tons was used by railways, 6,643,445 tons by leading industries, 1,240,558 tons for making coke, 428,929 tons for bunkering, 290,228 tons for artificial gas, and 419,003 tons by electric light and power stations, this last amount being only 3.5 per cent of Canadian consumption.

This small consumption for the production of electricity is explained by the fact that more than 89 per cent, 1,652,651 hp., of the installed capacity of central stations on Jan. 1, 1918, was hydroelectric. Every effort was also made by the Fuel Controller to substitute hydroelectric energy for that produced from fuels, and the results achieved are indicated by the following excerpt from the report:

> As an instance of what may be accomplished in the conservation of coal by using electricity to take the place of mechanical energy created from coal, it might be pointed out that in Montreal, at the instigation of the Fuel Controller, some 43,350 tons of coal was saved during the twelve months ended March 31, 1919, as the result of an arrangement whereby the Montreal Tramways Company purchased power from the Montreal Light, Heat & Power Company as an auxiliary supply. Similar arrangements have been made with twenty-seven other users of coal in the Montreal district, effecting an additional saving of more than 1200 tons yearly. In other parts of Quebec Province over 25,000 tons was similarly saved last year.
>
> The municipal corporations of Montreal and of Winnipeg had opportunities to effect yearly coal savings of about 30,000 tons and 10,000 tons respectively by purchasing power on the one hand for pumping water at Montreal and by selling power in the other case to the street railway at Winnipeg; but as these municipalities did not take advantage of the situations arising out of the Fuel Controller's appeals for conservation, those possible savings cannot now be recorded.

WONDERFUL POSSIBILITIES OF ELECTRICAL DEVELOPMENT

As to the future of electrical supply, Mr. McGrath calls attention to the wonderful possibilities in electrical energy to be developed from Canada's national waterways and to the savings in fuel to be accomplished through the use of water power. In his opinion:

> Canada is a country with wonderful possibilities in electrical energy to be developed from her natural waterways. That she has already taken advantage of part at least of these resources is shown by the fact that on Jan. 1, 1918, 1,652,651 hp., which is 89.6 per cent of all the power-producing capacity of the central stations in Canada, was developed from water powers. It would be well for the managements of all the Canadian railways to investigate the possibility of electrifying the portions of their systems where traffic is densest, in Ontario and Quebec, for example, not only with the view of making the best use of existing tracks but also with the view of conserving coal by taking advantage of the many water powers within economic transmission distances of the districts in question. Such investigations and the electrification of existing lines might easily result in the postponement for many years of further railway building in such territories.
>
> The steam railways are large users of coal, and, as is well illustrated in the case of the Montreal Tramways Company, they can make tremendous coal savings if electrified and operated with power from waterfalls. The conservation of coal and labor, the release of railway equipment and facilities for other purposes, the elimination of the fire hazard, to say nothing of the smoke nuisance now occasioned by steam locomotives, the increased capacity of existing trackage, yards and shops, and the superior ability of the electric locomotive to maintain higher schedules under adverse weather conditions, are some of the reasons for the urgent necessity of carefully considering the early electrification of busy sections of steam railways. As water powers in abundance are located within practical transmission distances of all the large centers of population in Ontario and Quebec, the development of some of these powers is a matter which should be studied jointly with the railway electrification problem.
>
> Coal used for producing power alone is said to be a degrading use of coal, because in locomotives and small stationary steam plants, for example, only about 4 per cent on an average of the energy in the coal is converted into and becomes available for use in the form of power. In the largest and most modern steam-power stations an efficiency of 20 per cent has been attained, and this is the reason why Great Britain is giving so much attention to the construction of super-steam plants to replace the multitude of inefficient boilers and engines throughout the country.
>
> When the energy of coal is turned into heat alone an efficiency of 80 per cent may be obtained, and this is why combined steam-heating and power plants are so much more economical than steam plants used exclusively for power. But even combination steam heating and power plants, with the limitations inherent in all small plants, cannot operate as economically as mammoth central stations. The Fuel Controller is of opinion that good reason should be shown before any isolated steam power plant is now permitted to be built or even continued in use in any part of Canada where water power is available. Power production by coal consumption under such conditions is a misuse of coal which should not be tolerated.

TO MY mind democracy in industry means co-operation with the workmen, in discussing with them the question of wages, hours of work and working conditions. The question of working conditions is the most important, and on it will depend the health and comfort of the worker and the efficiency of the plant.—*J. Parke Channing.*

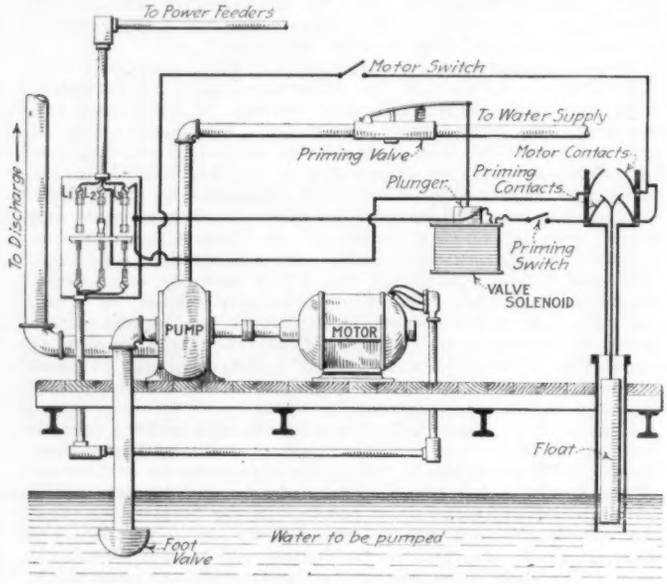
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

PUMP PRIMED AND STARTED AUTOMATICALLY

How a Motor-Driven Centrifugal Pump Was Controlled by Float Switch and an Electrically Operated Valve Made Up on the Job

Owing to the failure of an operator sometimes to prime a motor-driven centrifugal pump the following arrangement was devised to prime the pump and start the motor automatically. A push-button type of magnet switch was purchased to operate a 3-hp., 220-volt, three-phase, 60-



ARRANGEMENT OF AUTOMATIC CONTROL FOR PRIMING CENTRIFUGAL PUMP AND STARTING THE MOTOR

The float switch on the right is raised by the water until the priming contacts and the motor contacts are closed. The closing of the priming circuit energizes the solenoid, which primes the pump by pulling on the lever attached to the spring valve. The closing of the motor circuit starts the motor through the operation of the magnetic motor starter. When the water recedes the float switch drops back to normal by gravity.

cycle, 1800-r.p.m. squirrel-cage induction motor which is directly connected to the pump. All the other devices required were made up from material on hand at the plant. In this way about $200 was saved on the installation.

A sheet-copper float tank was made 3 ft. (91 cm.) long by 2⅞ in. (73 mm.) in diameter. This tank is lowered into the water through a 10-ft. (3-m.) length of 3-in. (76-mm.) conduit with a 3-in. pipe cap screwed over the top. The ¼-in. (6-mm.) rod which is fastened to the top of the float tank passes through a ⅜-in. (8-mm.) hole drilled through the center of the cap. The moving contacts which are placed at the top of the ¼-in. rod and the stationary contacts on a fiber framework above the rod are shown diagrammatically above. The solenoid which operates the spring valve has a pull of 8 lb. (3.6 kg.) and the lever on the spring valve is 12 in. (30.5 cm.) long.

If a back pressure is created in the priming valve before the motor operates the pump, an overflow valve will let the excess water run into the tank. This helps to raise the water level to a point where the motor switch will be closed. The motor will keep running until the water recedes below the bottom of the float tank. When this happens the weight of the float will make it drop away from both the motor and the priming contact to its normal position. If by any chance the float rod should stick, an auxiliary float which is connected to the lighting circuit rings a bell and lights a lamp when the water reaches a height of 1 ft. above the points where the motor should normally start and stop.

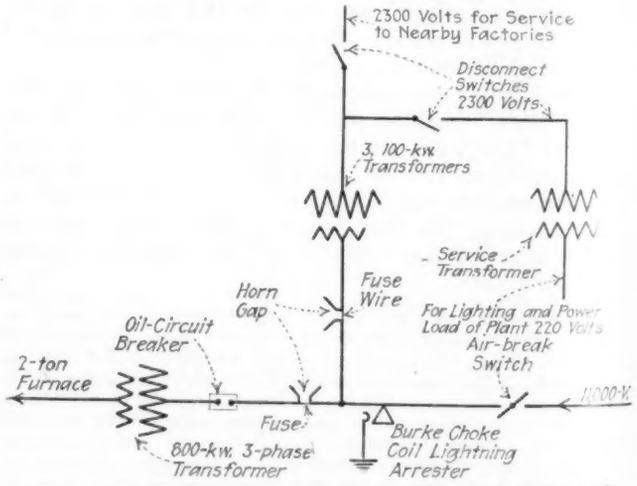
B. E. Rurey.

Chief Electrician George H. Smith Steel Casting Company, Milwaukee, Wis.

INDUSTRIAL-PLANT SUBSTATION UTILIZED FOR NEARBY PLANTS

Necessity for Crossing Railroad with 11,000-Volt Line Is Eliminated and Transformer Cost Is Reduced

The station is supplied from a 11,000-volt transmission line, the station being protected by a Burke choke-coil lightning arrester. The high-tension line divides on the factory side of the lightning arrester and air-break switch, one lead being connected to the 800-kw., three-phase fur-



WIRING DIAGRAM OF SUBSTATION SERVING ELECTRIC FURNACE AND NEARBY PLANTS

nace transformer through an oil circuit breaker and a fuse, and the other being connected to a bank of three 100-kw., 11,000/2300-volt transformers through a fuse. Past these transformers, the line again divides, one lead

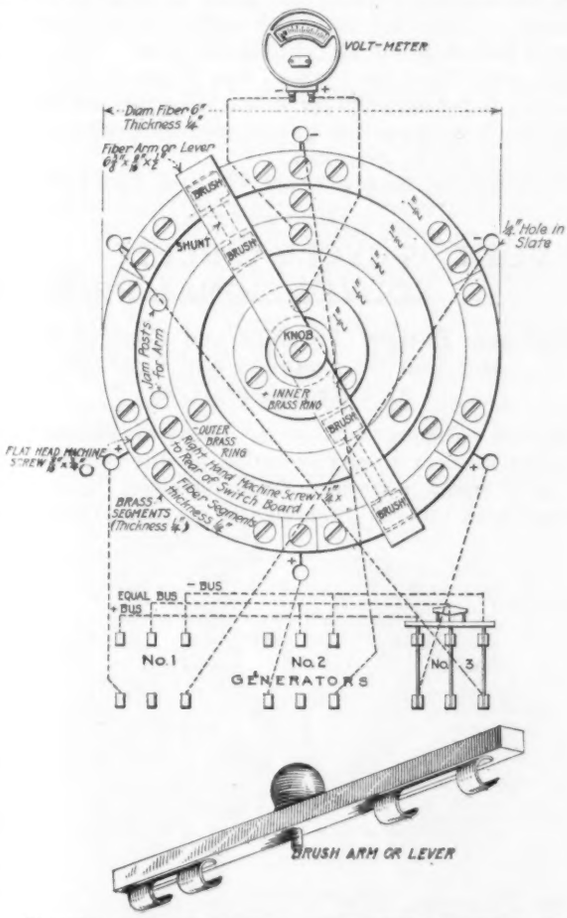
being connected to the 2300/220-volt power and lighting transformers of the plant and the other section being connected to the nearby plants requiring service. The fuses for this installation consist of ordinary fuse wire connected across the gap of two heavy wires mounted like horns. These have been found to serve the purpose very satisfactorily.

VOLTMETER SWITCH FOR PARALLELED GENERATORS

A Three-in-One Voltmeter Switching Arrangement Which Has Proved Practicable and Gives Good Service

An inexpensive voltmeter switch which has been in use for two years at plants where three generators are operated in parallel and which has proved satisfactory in every way is shown in the accompanying illustration.

This switch has overcome objections found in many types of switches, such as the following: Liability to injury from careless handling, liability to loosen and turn,



METHOD OF CONNECTING VOLTMETER SWITCH TO GENERATORS; ALSO CONTACT ARRANGEMENT.

liability to spread a film of dust or metal from segment to segment and cause a short circuit, liability to collect dust in pockets and destroy electrical connection in places, and electrician's weakness.

There is no cause for anxiety about the calibration of the meter when two or three machines are thrown together, for the same meter will be used for both or all machines. It is rather inexpensive to make, as the only machine parts are the two brass rings and the round fiber base on which the segments and rings are mounted. The plan view shows the connection for three generators. The three short segments can be marked No. 1, No. 2 and No. 3 generator respectively so as not to cause any confusion in reading. The two brushes are always in contact with the rings, and it is not likely for an arc to occur from one short segment to another on account of their distance apart.

PERTINENT ADVICE ON NORMAL GENERATOR OPERATION

Suggestions Refer to Hydroelectric Plant but Apply in Part to Any—Number of Generators to Operate, Division of Load, Quick Starting

Among the instructions which the Pennsylvania Water & Power Company issues to its station operators are some suggestions to generator attendants which might be incorporated to advantage in printed directions by other companies. They are in part as follows:

There shall at all times be sufficient generators connected to the system to take care of the load demand, and there shall not be more generators in service than are necessary to take care of the possible swings in the load. As far as possible there shall be at least one generator having field-relay energizing relays connected to each section of a bus isolated by bus reactors.

The load on the generators shall be equally divided as far as possible. Occasionally it may be necessary to throw more load on one section of the bus than another in order not to carry too much current through bus reactors.

When the generators are running warm operators shall be guided in loading them by the temperature indicators rather than by the wattmeters. (The maximum permissible temperature can be obtained from the manufacturer.)

Normally the excitation of the generators shall be so adjusted that they share the wattless current equally (exception is made in the case of the Lancaster (Pa.) generator, the excitation of which shall be such as will give normal voltage on the Lancaster system in case of separation). When the generators are running close to the prescribed temperature limits the wattless current shall be thrown more heavily on the generators having most leeway as far as temperature limit is concerned.

When the station is operating very close to maximum capacity the operator may crowd all the units but one to full gate opening and release the dash pot on the one, allowing it to take all the fluctuations in the load. In this way the behavior of the load can be closely watched and the necessary precautions taken for steam standby. While the responsibility for calling in steam in case of overload rests with one operator, any hydroelectric plant operator shall not neglect to notify him to call for steam standby when the load is swinging with 4000 kw. of the station capacity and to call for steam when the load is swinging within 2000 kw. of the station capacity.

Idle generators shall at all times have their field rheostats in position to give normal voltage when the generator is at speed. This decreases the amount of attention required when starting the generator, especially under emergency conditions, and also makes uniform starting conditions for the governor man. ALEX. BAUHAN,

Baltimore. Superintendent of Stations.

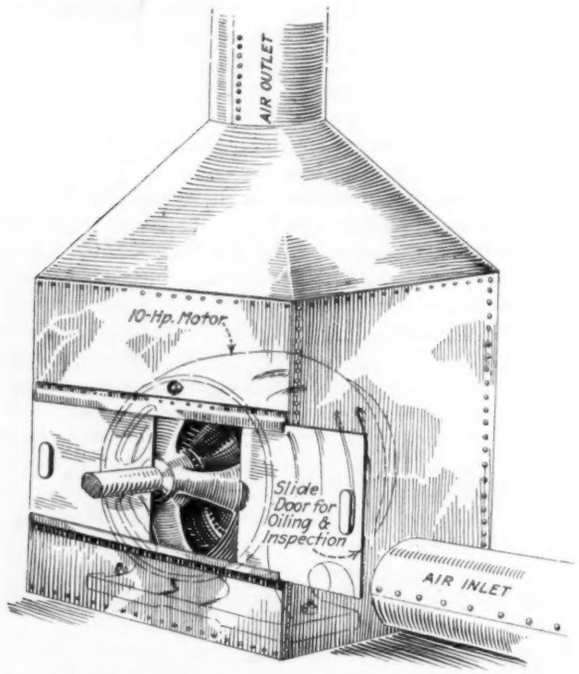
INDUSTRIAL APPLICATIONS

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

OPERATING CONDITIONS OF MOTORS IN A PULP MILL

Summary of Troubles in Plant with 1400 hp. Connected Load Shows that Bearing Trouble Amounts to Only 18 Per Cent

In further reference to Mark Meredith's article of August 16 and also Ralph McKinney's article of September 13, I quite agree regarding over-motoring, but not on some other matters. Of course, different mills have different troubles, so no direct conclusion can be drawn. However, a brief outline of the motor troubles encountered in eighteen months' operation of a small pulp mill in Canada is presented in tabular form herewith. A summary of this report shows that trouble can be attributed to the following causes: Bearings, 18 per cent; water, 31 per cent; chlorine, 18 per cent; acid fumes and steam, 37 per cent. From this it is apparent that bearing trouble in this plant exists to only one-fifth the extent that it does in Mr. McKinney's plant.



HOUSING FOR MOTOR SHOWING METHOD OF VENTILATING

To reduce the trouble from water, hoods were placed over motors so that no condensation or leaks could reach the interior of the motor. Troubles 4 and 8 were corrected by building a metal housing around the motor, supplying fresh air from outside and discharging it at the top as shown. Item 13 was taken care of by replacing a 7½-hp. motor by a 5-hp. motor, thus inducing heating and keeping the chlorine powder from dissolving. The motor involved in item 14 had one coil punctured; this was repaired and put back in service in one hour and a half. It might be noted that two motors drive white-water pumps delivering 2000 gal. (7600 l.) per minute; they are kept dry by maintaining a constant overload of 33 per cent with 85 per cent power factor. Very little trouble has been experienced with motors burning out from running single-phase, there having been only two such occurrences, which were attended to before any damage was done.

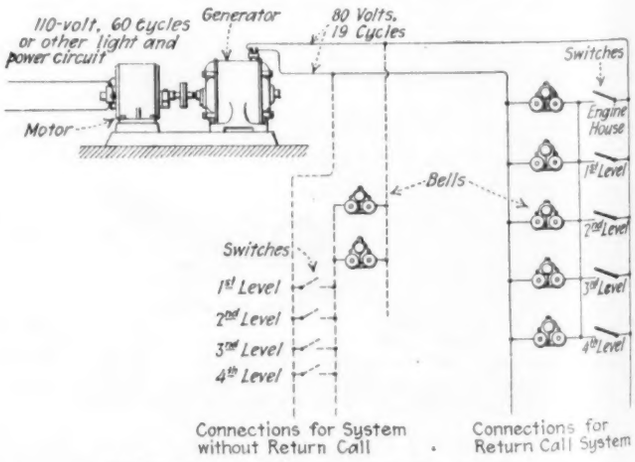
Two inspections are made of every motor each day, and a record is kept of maintenance and repairs. In this way the trouble is anticipated before it actually does any damage. There are forty-five motors with a total connected load of about 1400 hp. in the plant. The average yearly load factor for 1918-19 was 58 per cent, while the demand factor was 87 per cent. The demand factor is high but it is interesting to note that no trouble has been directly caused by overloads.

Port Arthur, Ont., Canada. H. E. STAFFORD.

80-VOLT, 19-CYCLE CIRCUIT SOLVES SIGNAL PROBLEM

Eliminates Battery Troubles and Contact Failures and Can Be Installed and Operated at a Reasonable Cost

Several schemes have been tried to eliminate the troubles incident to the operation of direct-current bells in mine signal systems. Some engineers have experimented with 110-volt, 60-cycle circuits and polarized bells, but the bells would not vibrate properly on the 60-cycle frequency. Others tried high-voltage, direct-current circuits, but the contact points burned so badly that these were considered impracticable. Another objection to the



MINE SIGNAL CIRCUITS OF TWO TYPES

direct current was the resultant electrolytic damage. More recently some of the electrical engineers in the iron mines of northern Michigan have found a solution of their signal troubles which eliminates all of these annoyances.

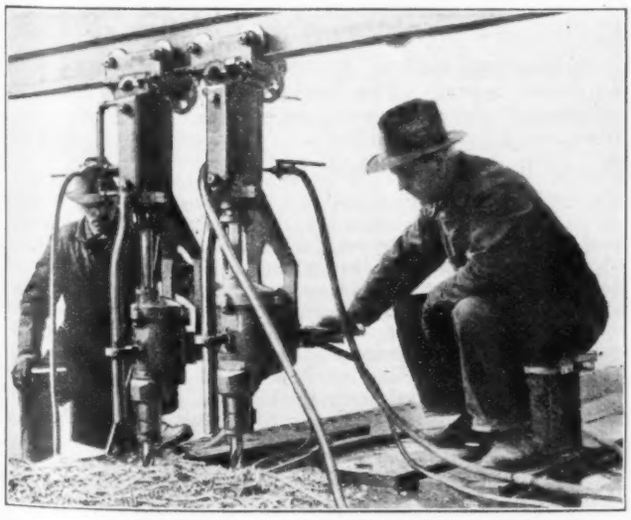
These men install a small motor-generator set, the motor of which operates directly from the 110-volt, 60-cycle alternating-current supply lines and the generator of which produces 80-volt, 19-cycle energy. This unit is designed to run continuously. It can do so economically because it consumes only about 1 kw.-hr. a day. Polarized bells are used, and the circuits are installed in lead-covered special steel-armored cable, which will support several hundred feet of its own weight when it is suspended vertically.

The size of the motor-generator selected depends of course on the number of bells that are to be operated simultaneously, but it usually does not cost more than $80 or $90. Polarized bells cost no more than other types. The list price on the 10-in. (25-cm.) size with steel gongs was about $21.60 each at the time they were purchased. Weatherproof switches were listed at $4.80 each. The diagrams show two common types of signal system employing this scheme.

PORTABLE ELECTRIC DRILLS MOUNTED ON I-BEAM SUPPORT

Two or More Can Be Fastened on One Beam for Drilling Holes in Steel Boilerplate—Hole Drilled in Eight Minutes

For drilling holes in steel boilerplate the Puget Sound Machinery Depot of Seattle, Wash., has assembled two electric drills on an I-beam crane, as shown herewith. The drills are hung on rollers so that the drills can be adjusted to any desired position. As many as four of these drills can be mounted on one beam, depending upon the length of beam. The drill, which is of the Van Dorn



DRILLING HOLES IN STEEL BOILERPLATE IN EIGHT MINUTES

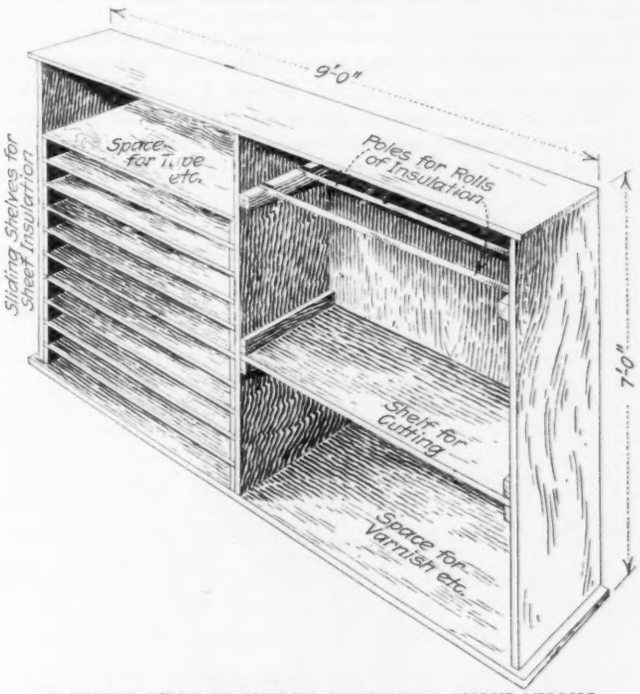
type, is fed to the plate by hydraulic means, a four-way cock being regulated to admit water to the cylinder at the desired rate.

The machines shown are drilling holes through three thicknesses of $1\frac{9}{16}$-in. (4-cm.) steel boilerplate. The time taken to drill a hole, including resetting, is eight minutes.

CONVENIENT CABINET FOR STORING INSULATING MATERIAL

A Repair-Shop Cabinet Constructed with Compartments for Sheet and Rolled Insulation—Sliding Shelves Facilitate Handling

A handy cabinet for storing insulating material has been constructed by the testing department of the Chicago Sanitary District. It is made of 0.75-in. (19-mm.) pine



CABINET THAT PROVIDES SPACE FOR INSULATIONS NEEDED IN REPAIR SHOPS

lumber. The main dimensions are: Length, 9 ft. (2.8 m.); height, 7 ft. (2.2 m.); depth, 5 ft. (1.5 m.). It is divided equally by an upright partition running back to front. Each half has a separate double door equipped with a lock. The left half has nine shelves about 5 in. (12.5 cm.) apart starting near the floor. These shelves slide out so that material such as sheet mica and stiff fiber may be handled without being bent or damaged.

In the top compartment, which is about 20 in. (51 cm.) high, is placed such material as tape, sleeving and washers. Labels are pasted inside the doors opposite each shelf as an index to what it contains. The right half has ledges on each side about 16 in. (40 cm.) from the top for round supporting bars, on which are placed rolls of fiber, varnished linen, etc. Halfway from the floor is a shelf on which the material which is pulled down from the roll may be rested for cutting. This shelf also slides out. Beneath this shelf are stored varnish, paint, oil, etc.

Devices for safe and orderly storage give a character to a workshop or laboratory that is lacking when material is heaped up in haphazard manner with constant risk of injury and certainty of lost time.

CENTRAL STATION SERVICE

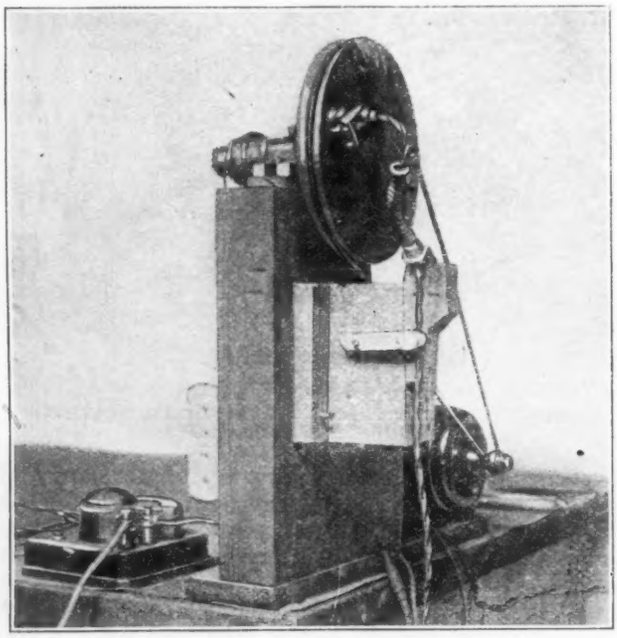
A Department Devoted to Commercial Policy and Management Topics, Including Methods for Increasing the Use of Electric Light, Power and Heat

LIFE OF APPLIANCE CORDS MORE THAN 500,000 BENDS

Home-Made Apparatus Gives Cord Combined Bending and Twisting Motions Similar to Conditions of Actual Use

A device to test the wearing qualities of flexible cords of electric appliances has been made in the testing department of the Commonwealth Edison Company, Chicago.

The device consists of a wooden pulley about 8 in. (20 cm.) in diameter mounted on a small bearing and belt-connected to a 1/15-hp. motor. On the face of the wheel, about 3 in. (7.5 cm.) from its center is a clamp mounted on a pivot so that the clamp does not rotate, although it is carried around on the wheel. A protective sleeve spring



METER DIAL COUNTS REVOLUTIONS OF WHEEL

of the kind mounted on the plug of an appliance cord is fastened as shown in the illustration with its free end about 3 in. from the circumference of the wheel.

Through this spring the cord to be tested is led, leaving about 3 in. (7.5 cm.) projecting beyond the spring. After the insulation is cut off the ends of the two wires are twisted together and fastened in the clamp on the wheel. By means of a rheostat the rated current is sent through the cord. When the motor is turned on the wheel runs at the rate of 200 r.p.m. and the wire is given a twisting and a bending motion. The treatment continues until the wire either short-circuits or breaks. Failure is likely to occur at any point in the 3 in. of cord tested. The motor is connected in series with the wire so that if it is broken the motor stops. For recording the number of bendings a watt-hour-meter dial is connected to the shaft of the wheel. In addition to this a curve-drawing ammeter is connected in the circuit. A good cord withstands from 500,000 to 750,000 revolutions. Inferior cords have broken at 100,000 revolutions.

OLD-FASHIONED CAMPAIGN IS CONSIDERED TO BE BEST

House-Wiring Solicitation with Electric Iron as Premium Brings Over 200 Old Homes on Lines of La Crosse (Wis.) Company in Month

Although the new-business department of the Wisconsin-Minnesota Light & Power Company of La Crosse, Wis., had been working hard on house wiring, it decided in August on a big drive. August was selected because it is usually a dull month. By the use of high-school boys to make a survey the names and addresses of the owners and occupiers of every unwired house had already been secured. There proved to be 1500 unwired houses; the population of the town is 40,000.

Taking advantage of rising markets, the department sold its men and company employees on the idea that there never would be a time when wiring could be done cheaper. This keynote was used to sell the public. It was in all advertising. The list of unwired home owners was worked to the limit. Direct-by-mail advertising proved to be the most effective. A first letter was sent stating the company's proposition and urging people to buy before prices advanced higher. It was followed each week with a stronger appeal. This brought the campaign home to "prospects" and produced quick results.

The company's proposition to its customers, as told by Charles B. Yonts, manager, was:

> We told our salesmen that we would use the same prices we had always used, but we would give an additional 5 per cent discount from our regular prices. The contractors to whom we are subletting our wiring work agreed to give us an additional 5 per cent if we would give an electric flat-iron with each house-wiring contract, and they further agreed to give ten 50-watt lamps free. This made quite an inducement, and it was advertised as an equivalent to 25 per cent reduction.
>
> We had our four salesmen working the town. Out of 107 contracts taken during the month of August, there were only four out on extensions. All the others were on existing lines. We sublet all of this work to one contractor. In the majority of cases competitive bids were given by other contractors, and, I might say, in the majority of cases we lost the wiring business. However, it was only a temporary loss as we lost only the wiring contract. We really got the electric service business in the long run, and primarily that was what we were after. So, although we signed up 107 contracts, we got more than twice that many customers.
>
> We were paying our salesmen all on a straight commission basis of 10 per cent, and where they fell down on taking

the contract we gave them $1.50 for each new service they obtained. So if they lost the job on a competitive bid, they got $1.50 for the service anyway and were well satisfied.

CONSUMERS' DEPOSITS IN THE STATE OF NEW YORK

Empire State Gas and Electric Association Outlines for Public Service Commission Suggestions to Govern Deposits

Careful consideration to the practices which should govern consumers' deposits has been given by a special committee of the Empire State Gas and Electric Association. This action was taken after the receipt of a letter from the New York Public Service Commission, Second District, stating that it would be glad to confer with representatives of the association on the subject. A committee, consisting of H. L. Mann, J. C. DeLong and H. O. Palmer, appointed by the executive committee, had a conference with representatives of the commission and it was decided that the association should submit its suggestions in writing. The statement prepared by the special committee and approved by the executive committee follows:

1. In the opinion of the committee, gas and electric companies should make it a practice to return deposits to their consumers as soon as such consumers have satisfactorily established their credit. The committee does not, however, believe that it is possible to make any definite rule regarding this matter as the period of time necessary to establish credit is variable and depends on many conditions.

2. The committee believes that it is good practice, whether or not it is required by law or order of the commission, for a company to pay interest on deposits annually if requested to do so by any consumer. On the other hand, the committee believes that an order requiring the companies to pay interest annually in all cases would entail considerable expense without commensurate benefits. The committee, however, sees no objection to an order requiring the companies to pay interest annually on demand.

3. The commission in New York State is somewhat restricted in reference to the handling of consumers' deposits by Section 63 of the transportation corporations law. In several other states the commission has made it optional with the company whether the amount collected from consumers as deposits to guarantee the payment of bills shall be kept in separate trust funds or shall be used by the company in the conduct of its business. In such cases, however, the commissions have provided that if a special trust fund is created the interest paid on deposits shall be at a much lower rate. For example, Colorado provides the rate of 4 per cent if deposits are kept in a trust fund as compared with 6 per cent if used by the utility in the conduct of its business. The Oregon commission requires 3 per cent and 6 per cent. It is interesting to note also that the state law in Massachusetts provides for 4 per cent on deposits and that the Connecticut commission has followed this precedent.

Under Section 63 of the transportation corporations law, as we understand it, the companies must pay 6 per cent interest, and apparently the commission has no authority to make modifications such as those cited above. If, therefore, the companies are required to put this money into a trust fund which would return probably not over 3 per cent, a burden of expense will be imposed which must ultimately be paid by the consuming public.

4. The committee also feels that placing the money in a trust fund does not bring any greater security. While unable to submit any definite figures, it is of the opinion that during the last twenty-five or fifty years there have been in New York State many more failures of banks and trust companies than there have been of gas and electric companies. If, however, it is felt that the present security is not sufficient, it is suggested that the difficulty might be overcome by the enactment of legislation making the holders of deposit receipts preferred creditors.

5. Referring once more to the matter of payment of interest, we note that the general practice in other states is that the interest is payable upon the return of the deposit or annually upon the request of the consumer. The matter appears to be left very largely to the discretion of the companies. Another interesting point in this connection is that where the action of the commission is not restricted by state law it seems to be usual for the commission's rule to contain a provision that in case the deposit is returned in less than a specified time, a year or less, no interest shall be paid. We fear, however, that such a provision in this state is not possible under Section 63, which specifically states that interest shall be paid for the time the deposit is held.

6. There appears to the committee to be a growing tendency among the companies of this state to require deposits in as few cases as is consistent with safety and to return deposits to consumers as rapidly as such action can be justified. Possibly there are some companies which have not yet fallen in line with this tendency, but we believe that they are few and that they will shortly see the wisdom of a change in their policy.

7. By way of definite suggestion it appears to the committee that it would be of benefit if the commission would address a letter to the gas and electric companies in the district. In such a letter the commission might suggest (a) that it is not of benefit to the companies to accumulate a large amount of deposits from the consumers on which interest at the rate of 6 per cent must be paid, (b) that in fairness to the consumers a deposit should be returned as soon as a consumer's credit has been satisfactorily established, (c) that the companies would probably find it to their advantage in maintaining the good will of the public to pay the accrued interest on a deposit yearly if requested so to do by any consumers. If the commission desires to do so, it could also state in the letter that the above suggestions are approved by the executive committee of this association as constituting good practice.

PERSONAL EXPERIENCE IS A GOOD SALES ARGUMENT

Evening Inspection of Well-Lighted Shop Windows Costs Mr. McLaughlin Price of a Gown, and He Tells Customers

Tell a personal experience and it has an appeal that a purely general sales argument lacks. J. C. McLaughlin, manager commercial department of the Potomac Electric Power Company, Washington, turned one which greatly interested him into a letter to customers using energy for window lighting. This is what he wrote:

Last Sunday night, accompanied by Mrs. McLaughlin, I went down town, and as a great many were doing at the time, walked along the business streets, looking at the displays in the show windows; that is, we looked at the displays where the windows were illuminated.

In one of the shops there was displayed a gown which attracted Mrs. McLaughlin's attention at once. She had not thought of purchasing, but this one appealed very strongly to her, with the result that my walk along F Street cost me the price of that gown.

Now, the thought struck me that if this gown was sold through the windows being lighted there must have been many more sales from the same cause. Thousands of people are out at night. They are looking for things to attract their attention. Your show windows are the very best advertising medium you have, and my advice would be to keep them well lighted at all times. The cost is very little when compared with other forms of advertising.

Most proprietors of stores have long since discovered the truth Mr. McLaughlin emphasizes. The few who stick to the old-fashioned plan of darkness or curtains should easily be convinced.

DIGEST OF ELECTRICAL LITERATURE

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Balancing of Dynamo Machines.—H. HEYMANN.—Lack of balance of rapidly rotating machines may be due to static or dynamic causes. The available types of balancing machines are divided into two groups, according as the axis of oscillation is free or constrained. The former type can only give perfect results if the unbalancing to be corrected is purely dynamic. A number of balancing machines are described, including several in use by the Allgemeine Elektrizitaets-Gesellschaft, the Norton machine of Ludwig Lowe, those of the Norton Grinding Company, of Akimoff, Schenk, Lawaczeck and others. Various methods of attaining true balance by progressive trial and of shortening the work by intermediate calculation are described.—*Technical Supplement to Review of Foreign Press,* Aug. 5, 1919. (Abstracted from *Elektrot. Zeits.,* May 22, 29 and June 5, 1919.)

Generation, Transmission and Distribution

Cause of Failure of High-Tension Insulators.—E. O. MEYER.—Great trouble has been experienced through the breakdown of insulators on the 65,000-volt transmission line in Kreuzwald. A number of photographs show the characteristic forms of the breakages that occurred. There are circular cracks around the head of the insulators and straight cracks down the side. Consideration of a number of possible explanations for this breaking of the insulators leads to the conclusion that their origin is not traceable to electric causes. An examination of the insulators supplied by different firms disclosed the fact that in some cases the middle and inside petticoats were formed with projecting shoulders that fitted into each other, whereas in other cases these petticoats had smooth surfaces. The breakages were noted almost exclusively with the former type. The existence of the shoulders no doubt causes unevenness in the quality of the porcelain near to the thickening of section produced, and the presence of the shoulders prevents exact centering of the three petticoats when assembling and may prevent the petticoats from settling down on one another, thus leaving an undue thickness of cement between the component parts of the insulator at the head of the insulator. Lastly, the joint formed by the overlapping shoulders may prevent bubbles of air from escaping from the cement. Notwithstanding these facts, a careful consideration of the possible effects on the strength of the insulators leads to the conclusion that it is not in the porcelain itself that the cause for the fracture lies. A series of tests were made by subjecting porcelain spheres to sudden changes of temperature. Four processes of heating to 50 deg. C. and suddenly cooling to 0 deg. C. caused cracks to appear mainly along great circles. After a time the spheres broke into pieces along great circles to a uniform depth, so that an outer spherical shell broke off, leaving an internal solid sphere. Tests made with actual insulators that were heated and then suddenly cooled by artificial rain showed lines of cracking exactly similar to those experienced in service. With good quality of porcelain the cracking did not occur, so the cause was sought in the cement. Careful tests were extended to this component of the insulator, and the suspicion was aroused that the cement between the tops of the various sections of the threefold insulators caused the breakages by expansion.—*Technical Supplement of Review of Foreign Press,* July 22, 1919. (Abstracted from *Elektrot. Zeits.,* April 17, 24 and May 1, 1919.)

Study of Long Transmission Lines.—P. BUNET.—Dealing with long transmission lines from the practical point of view, the author compares alternating currents with direct series current. He concludes: "The transmission of 100,000 kw. to 200,000 kw. a distance of 500 km. is possible under good conditions by employing alternating current with the material that is available to-day or will be to-morrow. It would probably be possible also to accomplish the result with direct series current on condition that important improvements in the machines were realized, but this seems at present much further away." The author pleads for the employment of French engineers, constructors and promoters in all such enterprises, holding that France has plenty of able technicians to insure success.—*Revue Générale de l'Electricité,* Aug. 2, 1919.

Installations, Systems and Appliances

Contacts and Contact Material.—H. VON FLEISCHBEIN.—The author states that platinum is the best metal for contact material, since it never oxidizes under chemical or electrical action. It is, moreover, sufficiently hard and has a very high melting point. Yet there are a good many complaints about the uncertainty of contacts using platinum. The author suggests using a sharp-pointed lower electrode, when one is above the other, in order to avoid the collection of dust and dirt. Sparking should also be prevented by the use of a suitable resistance capacity in parallel with the spark. Considerable attention has lately been given to the use of tungsten as a possible substitute for platinum. Tungsten is very brittle at ordinary temperatures but is capable of being worked under the hammer at a red heat. At ordinary temperatures it is not attacked by either acids or gases. The author relates a favorable experience with vibrating contacts of tungsten carrying considerable current and also describes methods of welding these contacts to their terminals.—London *Electrician,* Aug. 29, 1919.

Units, Measurements and Instruments

Ampere-Hour Meter with Friction Correction.—In most meters the percentage error introduced by friction increases rapidly as the load becomes very small. In the meter of the Allgemeine Elektrizitäts Gesellschaft now described the error at light load is compensated by having especial spiral segments on the commutator and brushes

mounted on a lever controlled by a series winding lying in the stray field of the magnetic circuit. By this means the lead of the brushes is varied with the load in such a manner as to compensate the error due to friction.—*Technical Supplement to Review of Foreign Press,* July 22, 1919. (Abstracted from *Elektrot, Zeits.,* May 8, 1919.)

Measurement of Leakance at Telephone Frequencies.—B. GATI.—This is an improvement on the barretter method of measuring leakance previously described by the author. The direct-current circuits of the two barretters are balanced by adjusting two sliders working respectively on a coarse and a fine rheostat which are connected. It comprises the high-frequency generator, an adjustable inductance and a two-way, two-pole switch by means of which can be inserted either the apparatus under test or a circuit made up of a standard condenser and resistance, both adjustable, in series. The apparatus to be tested being connected, the inductance is adjusted for resonance as indicated by the deflection of the galvanometer of the barretter balance reaching a maximum. The switch is then moved over and the capacity (C_1) adjusted until resonance is again established. Resistance (R_1) is then inserted until the galvanometer deflection is the same as before. Then, the author shows, the leakance $= R_1 w^2 C_1^2$. A list of precautions which must be taken is given. Tables giving the results of measurements on various insulating materials and on several types of porcelain and other insulators are included.—*Science Abstracts, Section B,* June 1919. (Abstracted from *Elektrot. u. Maschinenbau,* April 1, 1917.)

Telegraphy, Telephony and Signals

Radio Station of Eilvese.—S. M. SORENSEN.—An illustrated article describing the wireless station of Eilvese, Hanover, which is equipped with Goldschmidt generators. Comparisons are made between the results obtained at this station and at Nauen. The Eilvese equipment is cheaper in installation and in running costs and has an antenna only 250 m. high. The economic operation results from the high efficiency of the apparatus and the method of sending by change of excitation of the generator, so that the machines run light during the pauses between the signs. It is a great advantage that the Goldschmidt system produces waves with practically no harmonics. It has been found possible to increase the power of the station by running several generators in parallel. Great distances have been bridged and messages from Eilvese have been received in Honolulu. The relative strength of signals received in America from Eilvese and Nauen were, under the same conditions, 21.6×10^{-7} and 14.4×10^{-7} amp.—*Technical Supplement to Review of Foreign Press,* July 22, 1919. (Abstracted from *Elektrot. Zeits.,* May 22, 1919.)

Miscellaneous

Electric Testing and Properties of Materials.—ABRAHAM and E. BLOCH.—A paper on the absolute measurement of the frequency of high-frequency electric oscillations. The method is of great use in standardizing wave meters and for other purposes and consists in comparing the period of oscillation with that of a standardized tuning fork. The first operation is to compare, by photographic or stroboscopic methods, the period of a tuning fork for a thousand cycles a second with a clock. This operation can be carried out to an accuracy of 1 in 10,000. Sustained electric oscillations are then produced with a frequency equal to that of the tuning fork, the adjustment being effected by the method of beats with an accuracy of the order of 1 in 10,000. The sustained oscillations are such as to contain a series of harmonics (up to the 200th or 300th harmonic) and are produced in the manner described. It is then possible to compare the frequency of one of the harmonics with that of the circuit under examination, using an electric resonance method producing beats in a telephone receiver. By this means the wave length may be determined with an accuracy of one-thousandth.—*Technical Supplement to Review of Foreign Press,* July 22, 1919. (Abstracted from *Revue Gen. de l'Elec.* June 14, 1919.)

The Corrosion of Metals.—GUY D. BENGOUGH and O. F. HUDSON.—The report is divided into three main parts. The first is devoted to the question of the nature of the actions that take place when metals such as zinc, copper, aluminum and brass alloys corrode in neutral or nearly neutral liquids, for example distilled water and sea water. The second section is devoted to the consideration of the behavior of condenser tubes in similar liquids and the variation in behavior of different samples of tubes of nominally the same composition. In the third section an attempt is made to set out in some detail a statement of the practical problems of corrosion, which appear to the authors to be very different from what is usually supposed.—*Power,* Aug. 12, 1919. (Abstracted from paper read before meeting of the Institute of Metals, March 25, 1919.)

The Two Frequencies of Coupled Circuits.—J. SALPETER.—The existence of two frequencies in coupled circuits which when separate have the same frequency is physically explained by the fact that since currents in the two circuits differ by 90 deg. the magnetic field through the coupling coils is alternately stronger and weaker than that which otherwise would be produced by the intensity of the current at each instant in either of the two circuits. The current curve in each circuit, as is well known, presents beats, but the author observes that the passage from a beat to its successor takes place with a phase shifting of 180 deg. Therefore, if a single receiving circuit is exactly tuned to the common frequency of each of the coupled sending circuits when separately considered, the current generated in the receiving circuit during the first beat is annulled, or about annulled, by the current generated in it by the following beat, so that the resultant current is very small or zero. But if the receiving circuit is tuned to a certain frequency, higher or lower than the former, the current generated by the first beat will have a frequency a little lower than it, so that it gains or loses half a period during a beat and coincides in phase with the emf. at the moment of maximum of the following beat, during which it will lose or gain a further half-period, so as to be in phase with the emf. at the moment of maximum of the third beat, and so on. The author gives mathematical support to his explanation by developing in Fourier series the two last cases. In the former case only one frequency appears in the series, while in the second case two frequencies appear.—*Science Abstracts, Section B,* June, 1919. (Abstracted from *Jahrb. d. Drahtl. Tele.,* January, 1919.)

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

Plans for the publishing of future issues of the "Electrical World," necessitated by a continuation of the printers' strike in New York City, are outlined in the publisher's announcement immediately preceding page 825. The arrangement for the issuing of combined numbers makes it possible to give our readers a full measure of the "Electrical World's" service even under the most trying of circumstances.

At the meeting of the Electrical Supply Jobbers' Association in Cleveland this week the general discussion favored cooperation with contractor-dealers. The success of the co-operative movement in California was commended to the jobbers.

The Union Electric Light & Power Company, St. Louis, voluntarily restored its pre-war residence schedule on Oct. 31, with slight modification in the points at which the rates change. This meant a reduction of about 0.5 cent per kilowatt-hour.

A resolution of appreciation of the useful life and service of the late William D. Weaver, former editor of the ELECTRICAL WORLD, was passed by the board of directors of the American Institute of Electrical Engineers at its meeting in New York on Nov. 14.

W. L. R. Emmet, consulting engineer for the General Electric Company, discussed the possibilities of the electrically driven merchant ship before the Society of Naval Architects and Marine Engineers in New York on Nov. 14. He declared that, owing to recent improvements, the installation of electric drive in all large ships is justified.

An extraordinary meeting of the Ohio Electric Light Association will be held at Dayton, Ohio, on Dec. 3. It is called to consider an increase in dues, the National Electrical Safety Code now being formulated by the Bureau of Standards, and the best methods for carrying out orders of the state fire marshal in relation to inspection and safety devices.

The Common Council of Providence, R. I., has adopted a resolution authorizing the Mayor to make an agreement with the Narragansett Electric Lighting Company providing for an increase of between 10 and 15 per cent in power and commercial lighting rates. Investigation by the lighting committee of the council convinced it that the added revenue was needed by the company to meet increased costs of operation.

Summarized News

Principal Happenings Up to Closing of Forms for This Issue—Printed Nov. 24

W. W. Freeman, president Union Gas & Electric Company, Cincinnati, has been elected president of the Society for Electrical Development. He succeeds Henry L. Doherty, who has been the president since the society was founded nearly six years ago. The society directors also elected two new vice-presidents, Fred Bissell of Toledo, Ohio, and James R. Strong, New York, representing respectively the jobber and contractor branches of the industry. Charles L. Edgar, president Edison Electric Illuminating Company, Boston, and Arthur J. Binz, Houston, Tex., the new Jupiter of the Jovian Order, were appointed directors. J. E. Montague was elected chairman of the new Executive Committee.

At 11 o'clock on Thursday, Nov. 20, C. R. Huntley, president of the Buffalo (N. Y.) General Electric Company, opened the throttle on a new 35,000-kw. Curtis steam turbine in the company's River station. This new unit, together with three others each having a rating of 20,000 kw., brings the station rating up to 95,000 kw. All four turbines operate on a steam pressure of 275 lb. per square inch with 275 deg. Fahr. superheat, which involves the handling of temperatures around 700 deg. Fahr. The rated speed of the new unit is 1500 r.p.m., which makes the peripheral speed of the wheels of the last stage approximately 11 miles per minute. Besides President Huntley, P. S. Sellers, general superintendent; H. M. Cushing, mechanical engineer; H. G. Alverson, electrical engineer, and Alex H. Mason, chief engineer of the River station, the superintendents of operation and of distribution of the company witnessed the successful turning over of the large unit. Mr. Wernicke was also present as a representative of the General Electric Company, the builder of the turbine.

The potential seriousness of the bituminous coal strike situation is shown by the statement of the Geological Survey that the production of bituminous coal in the week of Nov. 8, during which the strike was in progress, is estimated at 3,477,000 tons, or approximately 29 per cent of the average for the four weeks ended Oct. 25, in which production was at the highest rate attained this year. As indicated in the reports from the mines for the week of Nov. 1, this production was outside of the central competitive district, which includes Illinois, Indiana, Ohio and western Pennsylvania. The union fields were almost completely shut down, the open-shop districts operated in part, and the non-union fields were little if any affected. Thus production was mainly in the general territory extending from parts of western and central Pennsylvania south to Alabama, in western Kentucky, Utah, Colorado and New Mexico. The only fields at work among those normally supplying the upper and central Mississippi Valley markets were those in southern West Virginia and Kentucky. Production in the week of Nov. 8 was, of course, the lowest recorded in recent years, for no strike has ever before affected all union mines at the same time as has this one. The daily average output in the week of 580,000 tons, was 54 per cent greater than on Saturday, Nov. 1, the first day of the strike.

The Director of Sales, War Department, Washington, D. C., is offering for sale by negotiation $500,000 of motors and also a number of generators.

The Bureau of Foreign and Domestic Commerce announces that the new classification of exports and imports will not be completed in time to put into effect Jan. 1. Instead it is now planned to put it into force Jan. 1, 1921.

Holiday sales have already opened, and while predictions from every section are to the effect that the demand will be greater than ever before it is equally certain that unless stocks are built up quickly the supply will run out long before the holiday demand develops.

Prices are not so steady as they have been. The report from New England shows a sagging in wire owing to lower metal costs. Increases in prices have been noted of from 25 to 30 per cent on electric toys, 12 to 15 per cent on fans, 20 per cent on fuse wire, 10 per cent on steel boxes and 20 per cent on safety switches.

Stocks of electrical commodities under the increasing demands are becoming worse and worse. Almost no stocks of armored conductor and non-metallic conduit now exist, while stocks of rigid conduit, schedule material and small sizes of wire are very spotty. Production on 4-amp. meters, it is reported, is considerably oversold, while in the East the same thing is true of safety switches. Lamp sales are increasing rapidly, as would be expected. The scarcity of lamp cord is liable to limit holiday stocks of portables, while the inability of producers to satisfy the demand for heater cord is alretdy beginning to tell on the production of heating appliances.

NEWS FOR THE WEEK ENDED OCTOBER 18

FALL SECTION MEETINGS OF ASSOCIATED MANUFACTURERS

About 300 Attend the Usual Gatherings—In Addition to General Work Much Time Is Given to Consideration of Standardization Matters

The regular fall section meetings of the Associated Manufacturers of Electrical Supplies were held in New York during the week beginning on Oct. 13. The membership of the sections combined is approximately 300, and this number were in attendance.

In addition to the general work of the sections in standardization of various materials and devices coming under their special attention, much time was given to the matter of the adoption of the standards approved and recommended by the different sections and to the suggestion that these standards should be issued as the standards of the A. M. E. S.

A desire to this effect on the part of the sections has been somewhat encouraged by the fact that from time to time other bodies have suggested joint meetings for the consideration of subjects of mutual interest, these suggestions coming from such associations as the American Institute of Electrical Engineers, standards committee of the National Electric Light Association, wiring committees, the Underwriters' Laboratories, Western Inspectors' Association, Compressed Air Society and others. This led to the suggestion that a general committee be formed from the sections, subject to approval by the board of governors and counsel, the duties of the committee to be to represent the association in matters of standardization and to evolve procedure by which section standards may become standards of the association, and generally to centralize the association's standards work to the end that all interested parties may be advised of proposed action and the necessary provision for same made. Subjects which may be considered are substantially as follows:

1. The determination of the relation of the Bureau of Standards at Washington to the initiation of codes, etc.
2. The proposed broadening of the American Engineering Standards Committee.
3. The proposed legislation conferring on the Bureau of Standards the power to establish standards of quality for manufactured product.
4. The desire of other national associations, such, for instance, as the American Institute of Electrical Engineers, to confer and coöperate with the association in the adoption of standards in which there may be mutual interest.
5. The determination of what shall be a standard of the association and the evolution of an orderly process by which, when desirable, the standards adopted by a section may become the standards of the association.
6. The desirability of the collection and preservation of standards already adopted by the various sections in form which shall make them readily available.

All such work would naturally come under the advice of counsel and every possible means be taken to avoid complications or anything which might be considered illegal. Work of this kind has been done heretofore, notably in the case of the American Society of Mechanical Engineers in the adoption of a standard for special threads of fixtures and fittings, and it would seem that such work would be of inestimable value to the manufacturers and to the public generally in the adoption of the very best and the elimination of superfluous types, etc. The matter of the tariff schedule was also considered by all the sections, and in arriving at a fair basis for fixing tariff many figures as to costs of material and labor were considered.

The matter of exports was also taken up and considered under the supervision of the international trade committee of the association. Special committees on both the tariff and exports are doing progressive work.

The A. M. E. S. is now in its fifth year and has accomplished extraordinary results in work such as, in a greater degree, is now contemplated through the General Standards Committee.

On Oct. 15 a large meeting was held in the association rooms of the chairmen of the tariff committees as appointed from the various sections. At this meeting a résumé of the work accomplished and to be accomplished was gone over, and many new plans were made for the future advantage of the supply industry.

On the evening of the same day a dinner meeting of the Wire and Cable Section was held at the Yale Club, which about sixty-five members attended. As is usual at the meetings of this section, much constructive work was arranged, followed by a dinner and "get-together" entertainment.

PUBLIC UTILITY SERVICE MUST BE UNINTERRUPTED

Employers' Group in Industrial Conference Draws Distinction Between Private Industry, Public Utility Operation and Government Service

Representatives of the employers' group of the industrial conference which has been meeting in Washington at the call of President Wilson prepared recommendations which dealt incidentally with the right to strike or to lock out in public utility service. A sharp distinction was drawn between the employment relations in the field of private industry, of public utility service and of government employment, federal, state or municipal.

It was recommended that, while the strike or the lockout in private industry is to be deplored, the right to strike or lock out should not be denied as an ultimate resort after all means of adjustment have been tried.

"The statement that the right to strike or lock out should not be denied," the employers say, "does not cover the matter of the sympathetic strike or lockout, where, for mere purposes of coercion, there is a combination deliberately inflicting injury upon parties against whom the assailants have no grievance, for the purpose of accomplishing an ulterior result. The sympathetic strike is indefensible, anti-social and immoral. The same may be said of the blacklist, the boycott and also the sympathetic lockout." They continue:

"In public utility service the public interest and welfare must be the paramount and controlling consideration. Modern social life demands the uninterrupted and unimpaired operation of such service, upon which individuals and communities are as dependent as is human life on the uninterrupted circulation of the blood. The state should therefore impose such regulations as will assure continuous operation, at the same time providing adequate means for the prompt hearing and adjustment of complaints and disputes."

In government employment the orderly and continuous administration of governmental activities is imperative, the employers declare.

It was also recommended that the "open shop" principle should not be denied or questioned.

SUCCESS OF THE INDUSTRY DEPENDS ON CENTRAL STATION

Samuel Insull Tells Electric Club of Chicago of Fundamental Source of Industry's Development and of the Need of Fair Rates

The success of the whole electrical industry is fundamentally dependent upon the success of the local central-station company in the various communities of the country. This was the dominant thought in the address of Samuel Insull to members of the Electric Club of Chicago at the electric show this week.

The speaker went on to say that probably between $500,000,000 and $750,000,000 is invested in the manufacturing side of the industry, which has an annual turnover of about the same amount. About four or five times as much capital, or in round figures between $2,500,000,000 and $3,000,000,000, is invested in the energy-producing end of the business, but the annual revenue is only about as much as that of the manufacturers. Thus the electrical manufacturing industry turns over its capital every year or eighteen months, whereas the central-station industry turns its capital only once every five or six years.

The central stations have come through the war with a better showing than any of the other utilities, but the electricity supply business is likely to get into a deplorable condition similar to that of some other utilities if the general trend of public sentiment is against the granting of fair rates on the capital invested. The central stations must receive adequate supplies of capital from year to year to make necessary extensions and improvements. Unless this is done there will not be a fair field for the sale of electrical machinery and supplies.

If a state public utility commission refuses to grant a company's request for relief, it is often because of a lack of proper public sentiment in relation to the questions involved. However, the number of employees, customers and investors interested in local utilities in the State of Illinois, for instance, is very large. If the facts of the utility situation were presented to these persons, they could wield so great an influence that public officials would bow to public opinion thus expressed and would deal fairly with the utility.

This arousing of public sentiment is the most important subject that can be discussed by any body of electrical men to-day, in the opinion of the speaker, who also appealed to electrical men to exercise their duties as citizens, joining together for the purpose of upholding the liberties of the country and combating the ideas of radicalism and Bolshevism to the end that the free institutions of the nation may be preserved.

MUNICIPAL ELECTRICAL ENGINEERS' CONVENTION

Rules for Standardization of Construction Discussed —Robert Gaskill, Fort Wayne, Ind., Elected President for Coming Year

Practically every paper and every discussion in the annual convention of the International Association of Municipal Electrical Engineers, held in Chicago Sept. 23 to 26, brought out the need of the adoption of a code of rules for standardizing electrical construction on outside line work and inside wiring. Municipal engineers, manufacturers, contractors and inspectors are all clamoring for the completion of the standardizing rules. R. A. Smith, the chairman of the standardization committee of the association, reported the progress that had been made on this matter during the last three years. By collecting data from all sections of the country a set of rules which it is hoped will be adopted generally has been drawn up for three classes of work, class *A* dealing with fire signals, class *B* with police signals, and class *C*, which has occupied the committee for the last year, with power and lighting construction. Before these rules are presented for adoption other subjects, such as street lighting, franchises, etc., will be incorporated in them.

Dr. C. P. Steinmetz, in a talk on the relations of the municipal engineer to the electrical industry, brought out the fact that trouble between the public and utility companies was usually caused by each party to the dispute having the erroneous opinion that the utility is a strictly private concern.

Two papers of William G. Keith of Chicago described respectively the fire-alarm system of that city and the street-lighting system of the city and its closest suburbs. Need for standard rules was brought out in a paper by F. B. Adam, St. Louis, in which he spoke of the position of fuses with relation to the switch on service connections. It was the sense of the meeting that in order to have the fuses dead for the purpose of changing them the switch should be placed on the incoming side of the line in ordinary service connections. An exception to this rule was thought to be desirable in case of meter protective devices and motor-starting devices.

A concrete example of the stresses on poles and guy wires was worked out by Dr. Morton G. Lloyd of the Bureau of Standards in a talk on pole-line construction for city streets. Dr. Lloyd pointed out the advantages of grading the wires from high voltage to low voltage, starting from the top of the pole. Robert J. Gaskill of Fort Wayne, Ind., who has lately returned from overseas duty as an officer, told of the interesting part played in the army by the Signal Corps in France. The use of the vacuum-tube arrester in protecting fire-alarm and police-signal circuits was discussed by Tyler Green of Toledo, Ohio. W. D'A. Ryan of Schenectady gave an interesting lecture on the history of illumination.

Clarence R. George was re-elected secretary of the association, this making his eleventh consecutive election

for that position. Other officers were chosen as follows: Robert J. Gaskill, president; Dr. Charles P. Steinmetz, first vice-president; R. C. Turner, second vice-president; W. P. Briggs, third vice-president; F. A. Cambridge, fourth vice-president; Clarence R. George, secretary; John Berry, treasurer; W. L. Potts, chairman executive committee.

THOROUGH DISCUSSION AT COLORADO MEETING

Power Sales, Electric Range Rates and Power Factor Are Topics of Greatest Interest—Norman Read of Denver Elected President

A feature of the meetings of the sixteenth annual convention of the Colorado Electric Light, Power and Railway Association at Glenwood Springs, Col., Sept. 18, 19 and 20, was the large amount of discussion which followed each paper.

President E. A. Phinney of Golden, Col., in his annual address spoke highly of the fair-minded attitude of the Colorado State Public Utilities Commission toward both the public and the utilities. Following the president's address and the routine business five convention papers were presented. These were: "The Incandescent Lamp from the Manufacturer's Standpoint," by S. E. Doane, chief engineer National Lamp Works, Cleveland, Ohio; "Salesmanship and Electric Power," by T. O. Kennedy, general superintendent Denver Gas & Electric Light Company; "Power Factor," by B. C. J. Wheatlake, local manager supply department General Electric Company, Denver; "Electric Cooking," by P. L. Miles, Edison Electric Appliance Company, Chicago, and the "Oil Shale Industry," by Dr. Victor C. Alderson, president Colorado School of Mines.

Mr. Doane's paper was a plea for the wider use of the foot-candle meter as an instrument for measuring illumination and for a fuller appreciation of the fact that increasing illumination in manufacturing plants will increase output.

Mr. Kennedy made the point in his paper that it is poor practice to sell electricity for power use too cheaply. He declared that central stations are too much inclined to shade rates for various reasons, principal among which is that of competing successfully with isolated plants.

Mr. Wheatlake presented a technical demonstration of the effect of power factor on the general operation and rates of the central station. He also explained the characteristics of the different power-factor corrective devices.

Mr. Miles' paper on "Electric Cooking" considered the various features of electric range selling and pointed out the advantages of the electric range load to the central station. This discussion which followed this paper contained criticism of the electric range manufacturers' policy of advocating low rates for electric cooking. The discussion brought out the belief of the delegates that there is no reason why abnormally low rates should prevail for electric cooking.

Dr. Alderson's paper discussed the opportunities of Colorado to become an oil-producing state through the development of the oil shale industry. Following Dr. Alderson's paper, James Doyle presented resolutions intended to protect the property rights of oil-land and water-power owners. These resolutions emphasized the importance of passing the Smoot oil-leasing bill and the Timberlake bill for tariff on tungsten ore.

E. A. Anderson of the Colorado State Public Utilities Commission spoke at the last session of the convention on the advisability of central-station companies creating favorable public sentiment for increases which they may expect. He stated that any company wishing an increase in rates should at first hold meetings with the local town officials, influential business men, business organizations and local newspapers to show them why there should be an increase in rates and to try to enlist their support. This, he argued, would put the facts of the case before the public in a way which would prepare their minds for any ruling which the commission might make later. He suggested that in a great many cases such procedure would prevent the long and costly litigation that sometimes follows a just ruling on the part of the commission.

The following officers for the ensuing year were elected: President, Norman Read, Colorado Power Company, Denver; first vice-president, S. E. Semrad, Western Light & Power Company, Boulder; second vice-president, T. O. Kennedy, Denver Gas & Electric Light Company, Denver; secretary-treasurer, F. P. Safford, Denver Gas & Electric Light Company, Denver.

SHIPMENTS OF WATERWHEELS MANUFACTURED HERE IN 1918

Geological Statistics Show that South Carolina Led All Other States in Installation, with Tennessee Second and New York Third

The Geological Survey, Department of the Interior, has completed statistics on shipments of waterwheels manufactured in the United States in 1918, based on returns received from practically all manufacturers of turbines and impulse wheels in the country. The aggregate capacity of waterwheels shipped in that year is indicated in the table, including the states in which the wheels are intended to be installed.

No information regarding importation of waterwheels was available, and it is assumed that owing to war conditions none were imported during 1918. The total horsepower of waterwheels exported during 1918 amounted to 108,376.

South Carolina led other states by far, with Tennessee second and New York third. Detailed figures follow:

State	Hp.	State	Hp.
Alabama	1,650	Nebraska	836
Arizona	1,049	Nevada	220
California	5,780	New Hampshire	8,210
Colorado	297	New Jersey	565
Connecticut	922	New Mexico	93
Delaware	247	New York	50,851
Georgia	21,107	North Carolina	2,826
Idaho	7,924	Ohio	245
Illinois	4,810	Oregon	5
Iowa	45	Pennsylvania	921
Kansas	1,200	Rhode Island	1,330
Kentucky	37	South Carolina	108,435
Louisiana	95	Tennessee	55,373
Maine	9,231	Utah	9,134
Maryland	548	Vermont	3,962
Massachusetts	23,417	Virginia	806
Michigan	16,462	Washington	5,565
Minnesota	29,621	West Virginia	3,632
Montana	205	Wisconsin	10,187
Total			387,843
Exported			108,376
Total			496,219

"RECONSTRUCTION CONVENTION" OF ELECTRICAL INSPECTORS

National Association Meeting at Springfield, Mass., Takes Liberal View of Code Development Along Lines Responsive to Engineering Progress

With a registration of nearly 150, the National Association of Electrical Inspectors held a "reconstruction convention" at Springfield, Mass., on Oct. 13-15. Underlying the meetings was an earnest desire to maintain inspection upon a plane always in close relation to the progress of the electrical art, combining strict adherence to the principles of safe operation with judicious and liberal interpretation of the code.

The convention was called to order by A. W. Hopkins of Springfield, past-president of the Western New England Section of the association, and the delegates were welcomed to the city by Mayor A. A. Adams. Washington Devereux, president of the association, responded, after which a paper on "The Beginnings of the National Electrical Code" was presented by F. Elliot Cabot of Boston.

Clarence D. Tuska, Hartford, Conn., then gave an address upon "Radio Developments and Their Relations to the Code," in which he urged that the rules committees associated with code revision keep in touch with the advance of the art of radio, in order that an elastic set of regulations may be maintained. The tendency toward increased power ratings in amateur stations, notably in the use of 0.5-kw. and 1-kw. sets, warrants special attention to the fire hazard. The speaker recommended that the grounding system in all sets of 0.1 kw. and over should include water, gas and sewer pipes. Aerial conductors should clear other conductors and metal flashing by at least 12 in. (30 cm.). It is considered advisable to connect antennae with the interior plant by a wire not smaller in cross-section than the sum of the gages in parallel, using a minimum of No. 6 for mechanical reasons. Grounding of antennae during storms is most essential as a preventive of fire risks.

Mr. Tuska closed his remarks by relating an amusing instance of detection of amateur receiving stations which were operating in Chicago during the early part of the war period. Many of these amateurs were equipped with audion receivers, which, when vibrating, act as high-frequency generators and emit waves which can be detected by a loop in the neighborhood. Much to the surprise of the violators of the governmental regulations, many of these stations were located by a government radio operator who traveled through the residential district in a moving van equipped with a radio loop.

ELECTRICAL INSPECTIONS AND THE POWER COMPANY

Percy H. Bartlett, engineer of installations, Philadelphia Electric Company, presented a paper at the afternoon session on "Electrical Inspection and the Power Company." The author pointed out that the adoption in some states of laws relating to safety measures would seem to necessitate sooner or later some form of additional inspection, at least in industrial establishments, and unless some combination is effected by which the same group of inspectors, either underwriters or municipal, also cover this phase of the situation, other provisions will probably have to be made.

Power companies' rules are generally limited exclusively to those problems dealing with the local system and methods of distribution, classes of motors to be used, voltage and phase limitations, etc., and their inspection is confined to these points and to determining that the contractual relations with the customer have been properly complied with by both parties and that the installation in general has been made in accordance with modern practice and is free from personal hazard. The power company can and usually does, through its contracts, require all installations to be made in accordance with the national and local standards adopted, but it is in a much stronger position to develop and deal in a friendly and impartial way with its customers than if the enforcement of wiring codes and rules were counted among its functions. Adequate rules are advantageous in relation to continuity of service as well as of safety.

The author favored inspection by insurance interests in preference to municipalities, on account of the financial bearing of preventive work and the superior opportunities, especially in considering smaller places, which the insurance experts enjoy of keeping in touch with national development of progressive methods.

REPORT OF SPECIAL A. I. E. E. COMMITTEE ON PUBLICATIONS

Change in Size and Title of "Proceedings" Approved by Board of Directors—Proposed Contents of Monthly Publication

Following is the full text of a report of the special committee on Institute publications, presented at the meeting of the board of directors of the American Institute of Electrical Engineers in Philadelphia on Oct. 10:

"In accordance with the resolutions adopted by the board of directors on Aug. 12 relating to the report of the committee on development, this committee has carefully considered the development committee's report and the communications relating to the publications of the Institute that have been received by the president, the secretary, the development committee and this committee up to the present time.

"In general, the views expressed by the membership are overwhelmingly in accord with the suggestions in the development committee's report, including the publication of additional matter in the *Proceedings*.

"In order best to meet the needs of the membership, and to promote the objects of the Institute as expressed in our constitution, namely, the advancement of the theory and practice of electrical engineering and of the allied arts and sciences and the maintenance of a high professional standing among its members, this committee recommends the following as the policy to be carried out when and as the necessary funds become available:

"1. *Transactions.*—That the annual *Transactions* be continued in accordance with the long-established policy; *i. e.*, with no change in size or character of contents.

"2. *Proceedings.* That the publication of a monthly periodical, heretofore designated *Proceedings*, be continued.

"3. *Contents of Proceedings.*—(a) That high-grade engineering and theoretical papers, in full or in abstract, shall continue to constitute the major portion of the monthly periodical and that the space devoted to such

papers shall be limited only by the amount of material available and the permissible expense; (b) that the substance of discussions at Institute meetings be published; (c) that the papers and discussions, in full or in abstract, as presented before sections and branches, be published as may be selected by the committee in charge; (d) that a portion of the monthly publication shall be devoted to material relating to the engineering art, other than that which is presented in Institute papers and discussions, such as descriptions of new developments characterized by notable advances; (e) that the publication of items relating to activities of the Institute and other organizations be continued and expanded; (f) that some form of descriptive index of electrical engineering literature be published, with due regard to the various indexes now published elsewhere and the avoidance of undesirable duplication.

"4. *Title of the Monthly.*—That the name of the publication be changed from *Proceedings of the A. I. E. E.* to a title that will better indicate the broader scope of the proposed contents.

"5. *Size of Monthly Publication.*—That the size of the monthly publication be increased to nine inches by twelve inches, the generally adopted standard for technical periodicals, as soon as it is found commercially practicable.

"6. *Advertising.*—That the Institute's practice of the past twenty-five years of carrying advertisements in the monthly publication be continued, and that, as heretofore, the editorial and advertising policies be entirely independent of each other.

"7 *Supervision.*—That the general supervision of the monthly and annual publications, including decisions regarding the publication of articles, papers, discussions and all other matter available for publication, be assigned to a publication committee, and that the carrying out of the policies that may be determined from time to time by the board of directors be delegated to this standing committee."

The special committee consists of W. I. Slichter, chairman; N. A. Carle, W. A. Del Mar, F. L. Hutchinson and Harold Pender.

The board approved the report and authorized the president to appoint a standing publication committee to formulate and carry out plans in accordance with the recommendations embodied in the report.

RESEARCH DEVELOPMENT THE THEME AT A. I. E. E. MEETING

Unusual Progress in the Understanding of Atomic Structure Was Indicated at Joint Meeting with the American Physical Society

It has become customary to devote the Philadelphia meeting of the American Institute of Electrical Engineers to the discussion of research problems. The meeting this year, held Oct. 10 and 11, was no exception, and there was the added advantage of a joint meeting with the American Physical Society. Plans were discussed by both societies for the extension of research work and particularly for the development of research workers. Several papers were read which throw considerable light upon the possible structure of the atom.

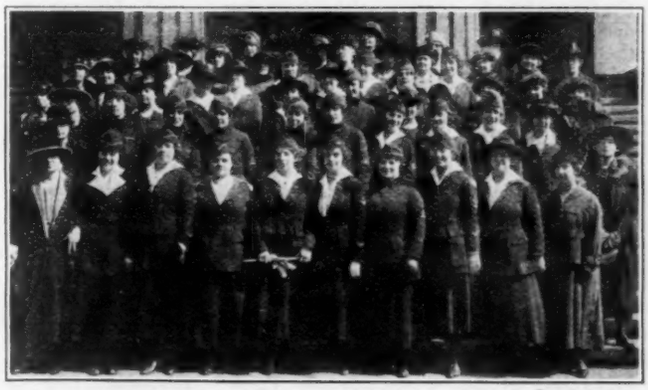
An interesting development which might become of practical importance was the study and demonstration of the "Piezo electric effect," which shows that electromotive forces are set up in certain crystals as a result of mechanical strain. This property of Rochelle salts, as investigated by A. McL. Nicolson of the Western Electric Company, was demonstrated by using a crystal to receive the notes of a phonograph record and to reproduce them clearly for the benefit of the whole audience.

The evening session was devoted to a discussion of the relations between pure and applied science, means of financially supporting research investigations and the development of trained research workers. Prof. H. A. Bumstead of Yale University called attention to the support given pure research investigations by the industries. He pointed out that either pure or applied science by itself would soon stagnate without the influence of the other. Pure scientists are encouraged by the realization of their dreams, and applied scientists would soon be marking time were it not for the new developments in physics and chemistry.

Col. J. J. Carty, vice-president American Telephone & Telegraph Company, spoke particularly of the debt of the public to pure and applied scientists and of the obligations of the latter to the public. He pointed out that, in the case of crises such as the nation has just passed through, scientists turn to the resources of nature for the supply of deficiencies. He predicted that the present industrial problems would ultimately be dealt with by scientists and engineers. In the discussions following these papers there appeared strong sentiment for the support of scientific work by the industries. This led to a spirited discussion of the advisability of taking successful research men from the universities for research work.

At the invitation of the Leeds & Northrup Company, the Saturday morning session was held at the company's plant. In a paper which was characterized by specific data to support its contentions, Mr. Leeds explained how the research laboratory of his company had proved a paying proposition. He gave these data in order to show that a small company as well as the larger ones may profit by the institution of formal research work.

Telephone Girls Who "Went Across"



Seventy-five telephone operators were enrolled by the New England Telephone & Telegraph Company for service in the American Expeditionary Forces, and fifty-two did duty overseas. This photograph was taken at a "welcome home" party given in honor of the group by the company at Boston on Oct. 1.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Removal of Brady Offices.—Nicholas F. Brady and James C. Brady announce the removal of their offices and the office of the estate of Anthony N. Brady to 80 Broadway, New York City.

Northern States Power Bonds Sold on Offering Date.—An issue of $1,500,000 Northern States Power Company first and refunding 5 per cent bonds, due April 1, 1941, was sold on the offering date by a syndicate composed of H. M. Byllesby & Company, Bonbright & Company, the Harris Trust & Savings Bank, Chicago, and the Guaranty Trust Company, New York. The bonds were offered at 86, to yield 6.15 per cent.

Government Water-Resource Engineers in Conference.—District chiefs of the seventeen branch districts of the water resources division of the Geological Survey were asked to meet in conference in Washington recently, to discuss administrative problems and the work being done in the various districts. This was the first meeting of the water resources chiefs of the Geological Survey since the outbreak of war. In addition to the district engineers, experts in the water resources division in Washington attended, making a total of twenty hydraulic engineers at the conference.

Hearing on Cleveland Rate.—On Oct. 7 the hearing on the Cleveland rate question opened before the Ohio Public Utilities Commission. The Cleveland Electric Illuminating Company submitted exhibits showing receipts, disbursements and operating expenses embraced in the schedules under which it has been operating. No other testimony was offered. W. S. Fitzgerald, law director of the city of Cleveland, announced that he had not decided whether he would introduce further evidence regarding the schedules or whether he would examine the company's officers. He was given the privilege of examining the schedules, and the hearing was continued for about three weeks.

N. E. L. A. Educational Bulletin.—This is to be published "intermittently" in the interests of the home study courses of the Accounting and Commercial Sections by the committees on education of those sections. Fred R. Jenkins, 72 West Adams Street, Chicago, is director and Ernest S. Butt editor. Vol. 1, No. 1, is dated October 1919. It contains articles on the need for special training and the importance of the courses offered. President R. H. Ballard, Chairman John G. Learned of the Commercial Section, Chairman R. W. Symes of the Accounting Section and H. B. Lohmeyer, chairman of the committee on education of the Accounting Section, contribute articles.

Rate Reduction in St. Louis.—The Union Electric Light & Power Company, a subsidiary of the North American Company, which controls the United Railways Company of St. Louis, has filed a petition with the Missouri Public Service Commission asking for permission to reduce its rates from 8½ cents to 8 cents per kilowatt-hour. The surcharge of ½ cent per kilowatt-hour was granted to the company a year ago and the grant expires Oct. 31. In explanation of the decrease asked, Louis H. Egan, vice-president of the company, said that St. Louis had a great future before her and that the electric company intended to do all in its power to develop the city by furnishing cheap electricity to the many industries now established there in the hope of inducing others to build plants.

Cleveland to Have Electrical Show in February.—As a result of a report made by its electrical show survey committee, the Cleveland Electrical League has decided to hold the next electrical show in February instead of some time this fall, as was originally contemplated. President Mathias Turner has appointed a committee to have charge of arrangements for the show, as follows: G. S. Milner, Erner Electric Company, chairman; G. E. Miller, Cleveland Electric Illuminating Company; A. J. Fitch, Fitch Electric Company; J. V. Becka, Electric Construction & Sales Company; J. L. Wollf, secretary Lighting Fixture Dealers' Club; A. M. Collins, Western Electric Company, and H. S. Wahle, Berg-Clark Electrical Company. It was decided to send a representative to Chicago to visit the show there and get ideas. It is the intention to make the display as nearly complete in every direction as possible.

Work of Radio Laboratory, Bureau of Standards.—The radio laboratory of the Bureau of Standards has issued a statement of the work which it is equipped to do in the calibration and testing of radio instruments of various kinds. For such work nominal fees are charged. Attention is called by the bureau to the reduced fees to amateurs for the calibration of wave meters and to the fact that electron tubes are among the items upon which it is equipped to make tests. The radio laboratory of the bureau also issues printed publications on radio subjects. In addition, there are issued special laboratory reports covering the work completed recently on which no printed publication has been issued. The principal radio subjects under which the bureau has prepared reports are: Electron tube generators, electron tubes as receivers, properties of electron tubes, aerials and direction finders, insulating materials at radio frequencies, production and measurement frequencies, radio measurements, testing of high-voltage and large current at radio of radio apparatus, cathode-ray oscillograph, suggestions for radio research, transmission phenomena, bibliographies, submarine radio and airplane signaling. A complete list of reports and a restricted number of copies of individual reports selected from this list will be sent to any one interested upon application to the Radio Laboratory, Bureau of Standards, Washington, D. C.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Washington State Association of Electrical Contractors and Dealers.—The annual meeting of this association took place in Seattle, Wash., on Sept. 11.

Iowa State Association of Electrical Contractors and Dealers.—Sioux City, Iowa, was the scene of the association's annual convention, held on Sept. 22 and 23.

San Francisco Association of Electrical Contractors and Dealers.—The new association offices are at 645 New Call Building, 72 New Montgomery Street.

Panama Section, A. I. E. E.—J. J. Henry, supervisor dredging division, Panama Canal, spoke on "Recent Developments in the Curtis Steam Turbine" at the Oct. 11 meeting of the section, held in Balboa Heights, Canal Zone.

Independent Electrical Contractors' Association of Greater New York.—This organization, which is a section of the Metropolitan District of the New York State Electrical Contractors and Dealers' Association, has issued its fifteenth annual reference book, dated 1919.

Lynn Section. A. I. E. E.—The Oct. 8 meeting of this section of the American Institute of Electrical Engineers was called "transportation night," the speakers being Mayor Walter H. Creamer, Ralph S. Bauer and Fred. A. Cummings, public relations representative of the Eastern Massachusetts Street Railway Company.

Electrical League of Cleveland and Cleveland Engineering Society.—Since Oct. 1 these two organizations and those affiliated with the Engineering Society have been jointly occupying the league's headquarters on the roof of the Hotel Statler. The library of the Engineering Society is also available now for the use of the league members.

Institute of Radio Engineers.—At the Oct. 1 meeting of the Institute Dr. E. F. Alexanderson described his barrage receiver, which made possible almost continuous communication with Europe during the war, despite intentional enemy interference, and also his alternator, by means of which transatlantic telephony has been accomplished.

San Francisco Electric Development League.—That the industrial development of the West depends upon its hydroelectric development was the opinion advanced by A. Emory Wishon, president of the Pacific Coast Section of the National Electric Light Association, at a luncheon held on Sept. 22 under the auspices of the San Francisco Electric Development League. At this affair a publicity campaign was outlined.

L. E. DICKINSON has been appointed general superintendent of the Mississippi River Power Company, Keokuk, Iowa.

H. L. COOK, formerly with the Texas Power & Light Company, has become sales manager of the Idaho Power Company, Boise, Idaho.

J. J. STEUERWALD has been appointed superintendent of distribution and construction of the Mississippi River Power Company, Keokuk, Iowa.

J. H. STEWART, superintendent of the municipal electric light plant at Troy, Ohio, has resigned to accept a similar position with the municipal electric light plant at Goshen, Ind.

GIUSEPPE FACCIOLI, chief electrical engineer of the Pittsfield Works of the General Electric Company and one of the managers of the American Institute of Electrical Engineers, has been made a commander of the Crown of Italy.

CHARLES H. LEATHAN, Frostburg, Md., has been appointed assistant manager of the Hagerstown & Frederick Railway Company, Hagerstown, Md. Mr. Leathan has heretofore been manager of the plant of the Frostburg Illuminating Company, a subsidiary organization.

R. W. KRASS, engineer of the National Conduit & Cable Company of New York City, has been appointed chairman of the A. I. E. E. membership committee, succeeding H. A. Pratt, manager of the industrial division of the Westinghouse Electric & Manufacturing Company in New York City.

DAVID DALY, formerly manager of the Houston (Tex.) Electric Company and the Galveston-Houston Electric Railway Company, has been appointed by Stone & Webster, who operate the above companies, to be manager of the Middle West district. Mr. Daly was born in 1878 and has been in the employ of Stone & Webster for the past nineteen years. Prior to becoming manager at Houston in 1905 he was manager of the Ponce (P. R.) Railway & Light Company. Mr. Daly has been quite active in N. E. L. A. work and in 1915 was elected president of the Southwestern Electric & Gas Association.

PHIL H. PALMER, president-elect of the Indiana Electric Light Association, is general manager and assistant treasurer of the Indiana Railways & Light Company, Kokomo, Ind. He has been connected with that company for fifteen years in various capacities, beginning as electrical engineer and superintendent of the lighting and power department for the predecessor company—the Kokomo, Marion & Western Traction Company. Prior to this Mr. Palmer was for five years manager of the Bloomfield (Iowa) Electric Light & Water Company. During the time that Mr. Palmer has been with the Kokomo company he has seen the business increase from 200 lighting and power customers and a total connected motor load of 20 hp. until now the company has 9400 light and power customers and a connected motor load of 12,000 hp. In the same time, under his observation, the power-plant rating has increased from 480 kw. to 10,200 kw., the interurban mileage has grown from 9 miles to 63 miles, and a steam-heating system has been added to the plant.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

ROBERT SIBLEY, who recently took up the duties of Pacific Coast editor of the ELECTRICAL WORLD and *Electrical Merchandising*, has for the last three years been editor of the *Journal of Electricity* at San Francisco. Upon purchase of the last-named publication by the McGraw-Hill Company, Inc., the editorial offices of the ELECTRICAL WORLD, *Electrical Merchandising* and the *Journal of Electricity* in San Francisco were consolidated, and Mr. Sibley was placed in charge. In addition to his new duties, he will still conduct the editorial department of the *Journal of Electricity*, which has become

ROBERT SIBLEY

an influential factor in the development of the Pacific Coast section. Mr. Sibley was born at Round Mountain, Ala., on March 28, 1881, but moved with his family to southern California at the age of eleven years. After graduation from the University of California as an honor student of the class of 1903, Mr. Sibley was made chief electrical engineer of the Mariposa Commercial & Mining Company at Bagby, Cal. From that position he was called in September 1903 to the University of Montana as professor of electrical engineering. In July 1907 he resigned to engage in consulting engineering practice. During the four following years Mr. Sibley was engaged in numerous engineering activities in western Montana, northern Idaho and eastern Washington, which included preliminary investigations for hydroelectric developments. One of these, the Thompson Falls project, was purchased later by the Chicago, Milwaukee & St. Paul Railroad and to-day is being used for the supply of energy for this railroad. In 1911 Mr. Sibley returned to California to accept an associate professorship in the University of California. In January 1912 he was made a full professor of mechanical engineering, which position he held until 1915. During the following year he toured the Orient, visiting many ports of Japan, China and the Philippine Islands, and made a special study of the possible commercial and engineering development of the Pan-Pacific area. Upon his return he spent several months in various parts of the East and South, later returning to California to become editor of the *Journal of Electricity*. Mr. Sibley has written a book, entitled "Elements of Fuel Oil and Steam Engineering," which is regarded as a standard authority on the subject of fuel oil in its uses for steam electric generation. He is a fellow of the American Institute of Electrical Engineers, a member of the American Society of Mechanical Engineers and has been chairman of the San Francisco Section of the latter society. On two successive occasions he has represented the San Francisco Section at the New York meetings of the society. In his long residence in the West Mr. Sibley has had occasion to visit its great power developments and possible power developments, which, together with his broad acquaintance and close contact with that great section of our country, gives him an unusual vision of the engineering work still possible and the problems that are involved. Details of this work he will help to lay before the readers of the ELECTRICAL WORLD from time to time.

P. M. CHAMBERLAIN has been appointed superintendent of substations of the Mississippi River Power Company, Keokuk, Iowa.

R. B. HOWLAND has resigned as superintendent of operation of the Mississippi River Power Company to become connected with another concern. During 1918 he was with the American International Company in Philadelphia.

NORMAN READ, president-elect of the Colorado Electric Light, Power and Railway Association, was born on the Isle of Man, England, and came to Colorado in 1890. He was graduated from the College of Engineering in the University of Colorado in 1905 with the degree of bachelor of science in electrical engineering. He was then employed by the engineering department of the Denver Gas & Electric Light Company, devoting most of his time until 1906 to work in the distribution department of the company. Then for two years he was engaged in designing and construction of hydroelectric projects in the Western States. In 1909 he was made electrical engineer for the Denver Tramway Company, which position he held until 1911. At that time, in addition to his duties as electrical engineer, he was made general superintendent of power for the same company. In 1913 he was appointed assistant general manager of the Colorado Power Company and in 1916 was made vice-president and general manager of the same company. Mr. Read is a member of the American Institute of Electrical Engineers and the National Electric Light Association.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

BUSINESS IN STANDARD PORCELAIN NOW HEAVY

Shipments of This Commodity in General Are Unsatisfactory, Although Stocks of Some Styles Are Available

Certain jobbers in New York City and other large cities have little interest in the low-voltage porcelain market because they have little business with territories where open wiring is used. In these cases it is not unusual to find rather fair stocks of knobs, tubes and cleats. They are the holdovers of stocks purchased some time ago and are depleted slowly. In other sections of the country, however, stocks of low-voltage wiring porcelain are extremely short and deliveries poor.

Manufacturers are having difficulty with the labor factor in their production. They are short of die makers, machinists and female operators, and production is much curtailed. A small item of iron nails is sufficient to hold up shipment at this time of "Nail-it" knobs. The nail shortage, let it be said, is quite general throughout the country.

The common run of knobs, tubes and cleats is badly behind in production while certain types not so popular are available from stock in small amounts. Three-inch tubes in particular are short.

Prices right now on stock materials are firm, but with much of 1919 production booked up the price on new orders is that at time of shipment.

RADIO SENDING BAN LIFTED FOR AMATEUR OPERATORS

Navy Department Ruling, Effective Oct. 1, Expected to Bring Increased Sale of Wireless Materials from Amateurs

Information has come through from the Navy Department to Washington that the ban on wireless sending stations has been removed as of Oct. 1. The removal applies to amateur technical and training schools and experimental stations and does not apply in any way to commercial stations. This action has been desired for a long time by the amateur operators, who have been anxious to get back their transmitting privileges, and who in anticipation of the lifting of the ban have been purchasing supplies and equipment. All amateur operators, however, will be required to secure a license from the Radio Service, Bureau of Navigation.

Sales of wireless-telegraph materials have been large all summer, and manufacturers now look for an increased volume of business. The marketing of the small radio-telephone set, operated from the commercial house-lighting alternating-current systems, has been held up pending patent settlements.

HEAVY BUYING SEASON OF DRY BATTERIES NOW ON

Sales Reach Peak of Season Between Now and Jan. 1—Jobbers Advised to Anticipate Wants by Ordering Ahead

Sales of dry batteries have started with a rush and will continue from now on up to the first of the year on account of a large demand for dry cells during this period. Where stocks have not been built up by manufacturers in anticipation of orders, they soon become depleted and the heavy orders soon overtax the manufacturers to such an extent that good deliveries are out of the question. Jobbers and dealers who expect to have dry cells and battery stocks on hand at any time during the next ninety days will do well to anticipate their wants by placing orders to cover their demands. Owing to deterioration it is not possible for jobbers and dealers to load up on stocks, but instead they must keep close watch of requirements in order to have fresh goods on the shelves at all times.

Battery schedules are a very important matter. For instance, one large manufacturer ships out all batteries and dry cells within forty-eight hours of the time that they have been made, thus giving jobbers and dealers plenty of time to dispose of their stocks. At this time manufacturers are booked up pretty well for the season's business, but when the volume of orders becomes heavy they increase the output as conditions arise. As manufacturers are doing everything possible to assist jobbers and dealers, standing orders for a given number of batteries and dry cells are the rule.

THE WEEK IN TRADE

BUSINESS this fall in electrical goods is rapidly forging ahead. One of the larger manufacturers reports September the biggest month in the history. Another prominent company booked 60 to 70 per cent more industrial business in the third quarter than in the first half of the year. Shortages, particularly of wiring supplies, are getting more and more acute.

Prices are up on Emerson motors 10 per cent, on flexible armored conductor around $5 per 1000 ft. and on non-metallic conduit from 8 to 15 per cent.

New England reports trouble in securing single-phase motors, flexible armored conductor, fixtures and storage batteries for automobiles.

Along the Atlantic Coast stocks of silk cord, flexible armored conductor and boxes, pull-chain sockets and small rigid conduit are low and hard to fill. There is considerable price cutting even in short stocks.

Stocks in California are fair. This section has placed about all of its orders for radiators.

In the Northwest strikes are holding down business. Jobbers report light sales. Retailers report large appliance sales. There is also a heavy demand for lamps. It is becoming increasingly difficult to secure shipments from the East, and a shortage of socket devices is expected in the next few weeks.

NEW YORK

Manufacturers of electrical apparatus report exceptionally good business booked since July 1, and in particular one of the largest companies has reported more business booked in September than in any month in its history. Another of the largest has booked 60 to 70 per cent more of industrial apparatus in the third quarter than in the first half year.

Supply jobbers report continued activity in all lines. Particular difficulty is experienced in obtaining sufficient stocks of silk-covered cord, flexible armored conductor and its boxes, pull-chain sockets, and from some quarters the smaller sizes of rigid conduit. At the same time quotations show a variation of prices which seems to be out of all proportion when

applied to some of this material which is short in supply. Particular reference is made to pull-chain sockets, armored conductor and its boxes.

Flexible Armored Conductor.—Prices have recently advanced $5 per 1000 ft.

Non-Metallic Conduit.—Discount has dropped from 60 to 55 per cent, making an increase of about 8 per cent.

Motors.—Emerson motors were advanced 10 per cent as of Oct. 1.

CHICAGO

Sales up to date indicate that retailers and jobbers in Chicago will probably do a better business in October than they did for the very good month of September. Building permits for the week ending Oct. 16 amount to more than $3,000,000, keeping up the high level set last month. The substantial increase in the number of men at work in the steel mills in this section has had a good effect on the general business sentiment.

Wire.—There is a scarcity, especially in weatherproof. The smaller sizes are short in practically all jobbers' stocks. Prices remain firm, with a 30-cent base for both rubber-covered and weatherproof and about 28 cents for bare wire.

Schedule Material.—Slow deliveries from the manufacturers keep stocks at a low level.

Snap Switches.—Jobbers are quoting snap switches at 25 per cent discount in standard package lots, under a steady demand. The 5-amp. single-pole snap switch sells for 22 cents net and the 10-amp. single-pole switch for 37 cents net, both in standard package lots. The 10-amp. single-pole push switch is quoted at 35 cents net.

Lamps.—A very heavy demand is under way. Stocks of the new white tipless lamps are in very good shape and sales have been rapid.

Conduit.—Stocks are generally short, but most orders can be taken care of for some time in spite of the existing steel strike. One jobber's price on ½-in. conduits is $75 per 1000 ft.

Non-Metallic Conduit.—Stocks are low. A price advance of about 10 per cent was put into effect on Oct. 1. Jobbers' net quotations on ¼-in. conduit are $35 per 1000 ft.

Flexible Armored Conductor.—A heavy demand is keeping stocks at a low level. On Oct. 1 a 10 per cent price increase was made. No. 14 twin conductor sells at a net price of $95 per 1000 ft.

Heating Pads.—Dealers have had unusually large sales for the last two weeks in this line. Current list prices are $6.50 for the aluminum pads and $9 for the flexible type.

Lamp Guards.—A price increase of 10 per cent has been put into effect. Jobbers quote standard packages of the wire lamp guards at $3.25 net per dozen for 25-watt to 40-watt lamps.

Small Motors.—The Emerson motors have undergone a general price raise of 10 per cent on Oct. 1. The heavy demand of washing-machine makers takes a very large volume of the small motor business.

Friction Tape.—Stocks have remained good, and prices are firm under a heavy demand. A good commercial tape is quoted at a net price of 45 cents to 50 cents in 100-lb to 200-lb. lots.

Transformers.—Manufacturers in this section state that the demand for standard pole-type transformers is very poor. Most recent orders have been for the larger-size power transformers of more than 150 kva. capacity. Some makers contemplate a price raise for about Nov. 1.

BOSTON

Trade remains extremely active. Jobbers report no falling off in business due to the steel strike or other labor difficulties. The demand for labor-saving appliances is enormous. New building operations are absorbing a large quantity of wiring material, but a decided slowing down in construction contracts is now to be seen. Single-phase motors, armored flexible conductor and storage batteries for automobile service are getting scarcer. Collections are holding up well, one large jobber reporting 95 per cent successful collections in the last four months, due in large part to the growing use of trade acceptances. Stocks are fair, apart from fast-moving lines. Prices are showing little fluctuation this week. The Androscoggin Electric Company, Lewiston, Me., plans to enlarge its Deer Rips hydroelectric station in the near future.

Motors.—Small motors are hard to get, especially in sizes below 5 hp. Single-phase motors are practically unobtainable at the moment in low-powered ratings. Prices are steady.

Washing Machines.—Representative makes are selling around $140 to $150. Price changes of late are few and far between. Stocks are hard to maintain. Many competing makes are being purchased. One factory producing washing-machine motors is striving to double its production in October, compared with September. It is hard to obtain winders experienced in this class of motors.

Welding Apparatus.—The demand is excellent. Prices advanced about 10 per cent early in September, but no recent changes are reported. A leading manufacturer quotes deliveries of about two weeks on standard equipments. Much attention is being paid at present to the development of equipment for special service.

Sockets.—Stocks are fairly good at present. Quotations are as follows: Key sockets, 27 cents net; keyless, 25 cents; pulls, 50 cents.

Automobile Starting and Lighting Sets.—The demand is so great that one of the leading factories is working twenty-four hours a day. Distributers confirm reports that trade is excellent, the chief difficulty being to accumulate stocks.

Conduit.—Rigid black pipe, ¾ in. diameter, sells for 10.53 cents per foot net and 1-in. pipe at 15.5 cents. Little complaint is heard just now as to shortage, notwithstanding the steel strike. Stocks are not large, however.

Lamps.—Manufacturers are very busy. Prices are steady. The end of the daylight-saving plan is expected to increase lamp consumption in general by 15 per cent.

Wire.—Bare copper wire holds at 28 cents base, weatherproof and rubber-covered wire quoting around 30 cents. Stocks are in fair shape.

Non-Metallic Flexible Conduit.—Smaller sizes are scarcer. Quotations on 7/32-in. are $26.50 per 1000 ft. net, and on 5/16 in., $29.50.

Armored Flexible Conductor.—No. 14 single-strip is quoted around $80 to $85 per 1000 ft. net. Deliveries are slow, and the demand is fair.

ATLANTA

So far the steel strike has been very little felt in this section, as stocks were in fair shape prior to the strike, but a feeling of uncertainty exists as to the immediate future covering deliveries. Much longer shipments are anticipated as a result of factories being flooded with orders while they are on a reduced scale of production. Buying in the electrical field continues active, and the total volume of sales is amounting to figures exceeding any transacted in the past. Reports from manufacturers and jobbers indicate that collections are being maintained at a healthy standard. Dealers are taking cash discounts and very little paper extension is observed, and this only in isolated instances. Labor appears easy and electrical contractors in general are busy on new construction and industrial expansion.

Conduit.—The demand at present exceeds the visible supply for black and white rigid. In spots Southeastern stocks are fair. We quote jobbers' price, f.o.b. Atlanta, on black rigid, 2500 lb. to 5000 lb., ½-in., $8.72; ¾-in. $11.57; 1-in., $17.10; 2-in., $37.22.

Steel Armored Conductor.—Southeastern requirements appear to be growing. Local stocks have reached a low level and promises from factories are very discouraging. A price advance of 6 per cent was registered this week. We quote jobbers' price on No. 14-2 per 100 ft., in lots of 2500 ft. to 5000 ft., $8.85, 5 per cent cash ten days.

Flexible Steel Conduit.—Activity has sagged, while prices remain firm. Stocks are in a fair condition as large orders are handled by drop shipments. We quote double strip net per 100 ft. coil to 1000 ft. on ½-in., $9.80; ¾-in., $12.74; 1-in., $20.58; 5 per cent cash ten days.

Flashlights.—Advancing fall has stimulated the market and a very satisfactory movement of both batteries and casings is noted. Battery stocks are well filled. Prices are steady. Jobbers' price on "Daylo" flashlights complete when purchased with ten or more unbroken unit packages is 40 and 10 off.

Cross-Arms.—Jobbers report continued activity and fair deliveries. We quote 75 per cent heart long-leaf pine standard, 3¼-in. by 4¼-in., for 1½-in. pins, 1000 linear ft. and over,

f.o.b. Atlanta, on two-pin, 3-ft., 33 cents; four-pin, 4-ft., 44 cents; four-pin, 5-ft., 55 cents; eight-pin, 8-ft., 88 cents.

Motors.—Requirements from textile mills and other industrials have shown a decided increase this week covering capacities up to 200 hp. Fairly good deliveries are being made from Southeastern distributing centers up to 50 hp., with an accompanying tendency for long deliveries on the larger sizes.

Non-Metallic Conduit.—From all reports available, stocks of this material are very low in this section. Factories are behind on orders and no definite delivery dates are being made. Prices have advanced approximately 15 per cent, but this does not seem to have any effect on the incessant demand. We quote jobbers' prices net per 100 ft. on lots of 2500 ft. to 5000 ft. on 5/16-in., $3.30; 7/32-in., $3.03; 2 per cent cash ten days.

Wire.—One jobbers' base price for both weatherproof and rubber-covered is 28 cents. The demand is very heavy, and it is almost impossible to obtain any reasonable quantities of the popular sizes such as No. 6, No. 8 and No. 10 weatherproof.

SEATTLE—PORTLAND

Strikes in Seattle are the rule, not the exception. At present four strikes are in progress—of the allied building trades, the job printers, the gas workers and the inside employees in the cleaning and dyeing trade. The first three crafts have been out since Sept. 1 and the last for one week. As a result commercial activity is being hampered and in some instances reduced to practically nothing. Electrical jobbing concerns are particularly affected by the building strike, which shows no evidence of an early end.

Seattle jobbers report sales during the week as a shade lighter than for the previous week, and indications point to further decreases. Retailers, on the other hand, note increasing sales along domestic appliance lines, particularly washing machines, irons, socket-device heaters and grills. Lamp sales for residence uses are growing. This volume will be multiplied when the building strike is settled.

Portland manufacturers and jobbers report increasing delays in delivery of shipments. General sales are good, but stocks are practically diminished. The demand for lamps is particularly active at the present time. Warehouses that were full and overflowing with lamp stocks a week or two ago are now feeling the need of immediate replenishment in order to maintain stocks. There is a noticeable tightening in prices along certain lines. It is predicted that there will be a very definite shortage of energy-consuming devices by the holiday time, due to the active buying at the present time and to the increasing difficulty in securing shipments from the East.

Electrical contractors in the Portland district report an abundance of work at the present time, and prospects for the future look good. Electrical retail stores report business as very active. One store reports at least 20 per cent increase over the same month last year and a very appreciable increase over the month of August. The greatest activity is in washing machines.

SAN FRANCISCO

Continued fine weather and good labor conditions in the building trade have resulted in steady and ever increasing building. Local stocks are only fair, because Eastern shipments are uncertain. Although the stevedores' strike in San Francisco still continues, conditions are growing better and congested freights are beieng moved. It is generally predicted that the shipyards, whose workers are out on strike, will be closed down until at least the first of the year, and possibly for six months longer. About $150,000,000 worth of contracts are being held up on account of this strike.

Lamps.—Stocks and deliveries are good, and the handling of agents is becoming more and more standardized. The only exception to this rule is for the new white Mazda. A strenuous effort was made to anticipate orders before the lamp was advertised locally, but the first batch was speedily taken and the supply has been far behind the demand ever since. Dealers' opinions are that it has been sold as a novelty thus far, principally for portable use, and has been scarcely touched at all in the window-ilghting and industrial fields.

Ironing Machines.—Prices have slightly advanced, principally in the attachment for electric heat. The demand is not quite so insistent as it was a few months ago. A popular size is 42-in., gas-heated and motor-driven, and there is keen competition for yearly contracts. This style sells to dealers in single lots for $129.25 for Coast points, or $121.60 in yearly dozen contracts.

Radiators.—In 1918 many dealers and consumers found themselves disappointed through under-anticipation of the demand. Realizing this condition, jobbers and dealers are urged to place advance orders this season, and jobbers have already been supplied with their winter season's requirements and report that fully two-thirds of their dealers are similarly protected.

Fuses.—Contrary to belief, there has been no reduction in the price of standard cartridge fuses. Conditions have been made easier by the proviso that various amperages taking the same size of case may be assorted to make the various quantities of standard packages, and a ten-assorted-package price that figures about 10 per cent below the standard-package price has been inaugurated. In the 0-amp to 30-amp, 250-volt size, for instance, this price figures $10.80 per 100. Renewable fuses have increased about 20 per cent, now selling in package at a price of 80.33 each for the above size.

METAL MARKET SITUATION

Upward Revision of Outside Copper Prices Follows Return of Ordering—Zinc Improving

The return of ordering in the copper market has attracted an upward revision of outside prices. This does not mean that any phenomenal buying has taken place in the last week but that, compared with several previous weeks, recent purchasing has been noticeable. Outside prices have come up ⅝ cent to 22 to 22.25 cents a pound for prompt and October, while for November delivery the price is ¼ cent higher and for December another quarter cent. Asking prices are not so favorable for these last two months, but are set at 22.25 cents.

The large producers are showing a tendency to waver, but their feet haven't slipped yet. They are holding October at 23½ cents a pound and waiting for some word from the large consumers. Meanwhile the outside market is booking some orders for late year delivery, but in smaller volume than a week ago. Inquiries, however, are showing a healthy increase. From records of the purchases made by many large consumers it is shown that sufficient fourth-quarter copper has not been bought to last over the end of the year. Hence a reasonable witholding of a price revision downward by the large producers, in order to be in at the killing when the call does come for copper for November and December delivery. An immediate substantial decline would upset the market too much to be healthy.

The price of lead is holding in New York at 6.25 cents. Although there is active inquiring, outsiders are offering little of the metals and producers' sales are light.

Zinc prices have increased a bit, and an advance in London has added strength to the domestic market through hope of renewed export business.

Scrap coppers are responding to new copper advances and are higher by 1 cent than they were last week. The brasses are up from ¼ cent to ¾ cent. Scrap zinc has risen a quarter of a cent too.

NEW YORK METAL MARKET PRICES

	Oct. 8	Oct. 15
Copper:	£ s d	£ s d
London, standard spot	103 15 0	105 15 0
	Cents per Lb.	Cents per Lb.
Prime Lake	21.50 to 22.00	22.50
Electrolytic	21.37½ to 21.62½	22.00 to 22.25
Casting	20.37½	21.50
Wire base	26.00	26.00
Lead, trust price	6.25	6.25
Antimony	8.50	8.50
Nickel, ingot	41.00	41.00
Sheet zinc, f. o. b. smelter	10.50	10.50
Spelter, spot	7.70 to 7.80	7.80 to 7.90
Tin	55.00	55.50
Aluminum, 98 to 99 per cent	32.00 to 33.00	32.00 to 33.00

OLD METALS

	Cents per Lb.	Cents per Lb.
Heavy copper and wire	17.00 to 17.50	18.00 to 18.50
Brass, heavy	8.75 to 9.00	9.50 to 10.00
Brass, light	8.00 to 8.25	8.25 to 9.00
Lead, heavy	5.10 to 5.25	5.10 to 5.25
Zinc, old scrap	4.50 to 4.75	4.75 to 5.00

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Two-Stage Air Compressor for Tire Inflation

A motor-driven two-stage air compressor designed quickly and satisfactorily to inflate the pneumatic tires which are used on large-size automobile trucks has just been developed by the United States

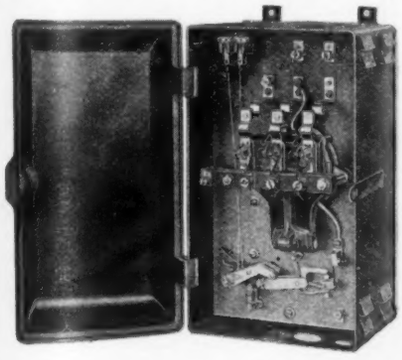
EXTRA LARGE AIR TANK MAKES INFLATING LARGE TIRES EASY

Air Compressor Company of Cleveland, Ohio, and is known as the "Usaco Giant de Luxe."

The high-pressure air tank is of sufficient capacity for very severe service in inflating tires up to sizes of 44 in by 10 in. (111 cm. by 25 cm.)

Safety Starting Switch for Small Induction Motors

To make the starting of small induction motors safe and "fool-proof" the Electric Controller & Manufacturing



"FOOL-PROOF" STARTING SWITCH

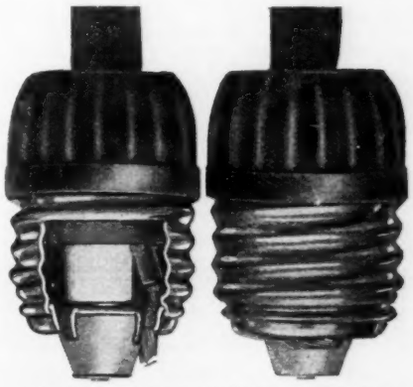
Company of Cleveland, Ohio, has just developed a push-button alternating-current switch which is said to operate on a principle entirely new in motor-starting practice.

The illustration shows the new starting switch with the cover of its steel box open. On the left-hand side will be noticed two wires extending the length of the slate. These are said to give overload protection of the inverse-time-element type both while the motor is starting and while it is running. The two wires are stretched, and the operating value of this overload protection is adjustable by changing the tension of the wire. If too much current is being taken by the motor, these wires expand, causing the small contact at the bottom to be opened, and this will in turn de-energize the magnet coil and cut the motor off the line. It is then necessary to push the "start" button before the motor can again be started.

The steel box inclosing the switch has conduit connection for all wires. To start or stop the motor it is only necessary to push the proper button.

Swivel Attachment Plug

A swivel attachment plug that is completely assembled when shipped and need not be taken apart to wire, and in which



NO NEED TO DISASSEMBLE THIS PLUG

there are no screws, has been put on the market by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. It consists of an inner and an outer member revolving on each other. The wires are connected to the inner member, while the outer members comprise the ordinary screw shell and a knurled head made of heat-proof molded insulation.

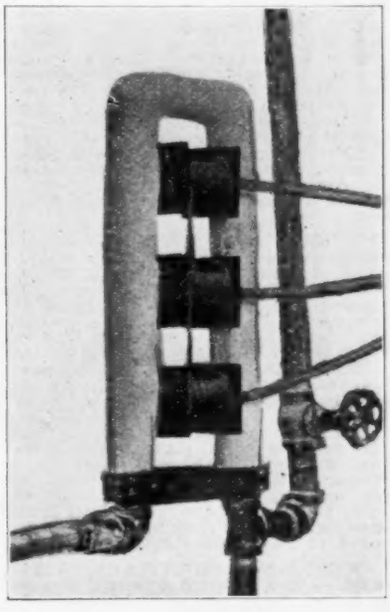
In wiring the new plug two wires are stripped about 3/8 in., and one is pushed into a center opening of the inner member and the other through any one of four concentric openings of the same number. By means of a soldering iron one wire is then sweated in the center opening, while the other, after being turned over into a groove on the inner member, is soldered thereto.

After being attached to a cord there is said to be no possibility of the parts of the plug becoming separated when being unscrewed from a socket.

Heater for Compressors of Stone Cutter

To heat the air used in compressors for surface cutters employed in stone cutting the Cushman Company of Barre, Vt., has developed and is manufacturing a "magnetic" heater which is claimed to be superior to the customary resistance heater since it is designed not to burn out. Another of its features is the maintenance of constant temperature regardless of the varying temperature of the air that passes through it.

The new heater consists of a U-shaped, hollow cast-iron frame with the two ends finished for standard pipe connections.



HEATER MAINTAINS CONSTANT TEMPERATURE

Between the two facing sides of the frame are three laminated iron cores, covered with sheet mica, surrounded by about a hundred turns of insulated wire. Between each two layers of wire is placed a sheet of asbestos for insulation. The frame itself is covered with asbestos and taping to keep in the heat. The heat passes from the cores to the frame, maintaining it at a high temperature. The new heater operates on a three-phase circuit of any standard voltage and frequency, and is rated at 3 kw.

Manufacturers' Activities

THE POOLE ENGINEERING & MACHINE COMPANY, Baltimore, Md., on Oct. 1 opened a branch office in Boston in the Old South Building, in charge of Robert W. Catlin, assistant manager.

THE R-P-R COMPANY, sales engineer, handling power-plant equipment, has been organized with Barrett Rogers as manager. The headquarters of this company are at 364 Monadnock Building, Chicago.

RUSSELL STOLL & COMPANY of New York City have opened a Chicago office with Roy E. Shawlin as Western manager. The Chicago office will establish distribution in the Middle West on marine electrical equipment, watertight fittings and fixtures and other electrical specialties.

THE BURKE ELECTRIC COMPANY, Erie, Pa., announces that it has purchased the good will and all records, patterns and drawings, special tools and equipment of the C. & C. Electric & Manufacturing Company and is prepared to fill orders for spare parts, duplicate machines, welding and other supplies.

THE GENERAL MOTORS CORPORATION has acquired the Domestic Engineering Company, Dayton, Ohio, according to an announcement recently made by W. C. Durant. The Delco company will be merged with the General Motors Corporation and hereafter operated as a branch under the present management.

THE LIDDELL ELECTRIC MANUFACTURING COMPANY, manufacturer of electrical specialties, 481 North Washington Avenue, Bridgeport, Conn., announces that it has taken over the Bridgeport Electric Products Company. The company intends at the present time to produce crown telephones, wireless receivers and push-buttons formerly manufactured by the Standard Manufacturing Company, and also to solicit and manufacture new lines of electrical devices. The company is distributing its goods through jobbers in some territory, and direct to dealers and contractors where there is no connection with jobbers. R. Liddell is president.

PETER S. KLEES has announced his resignation as manager of the Franklin Incandescent Lamp Works of Westinghouse Lamp Company of New York City to become associated with the Pierce Fuse Corporation of Buffalo as vice-president and sales manager. Mr. Klees has been prominent in the lamp industry for many years, having joined the organization of the American Incandescent Lamp Company back in 1899. In 1905 he went to Hartford as a member of the sales department of the Franklin Electric Manufacturing Company, later becoming sales manager and then also vice-president, continuing in this position until the sale of this company in 1918 to the Westinghouse Lamp Company. He then became manager of the Franklin Works and removed to New York City.

AMERICAN CONDUIT SPLITS BUSINESS.—The General Electric Company has leased the rigid-conduit business of the American Conduit Manufacturing Company, New Kensington, Pa. This business, which will continue to be operated at New Kensington, will be conducted by the Sprague Electric Works. The Galvanite and American brands of rigid conduit will be continued, and no change is contemplated in the terms or conditions under which the trade has been dealing with the American company. Plans are being made for the enlargement of the plant, and additional equipment will be installed. There will be no change in the personnel of the American Conduit Manufacurting Company, according to a statement by D. Hayes Murphy, president of the company, but the name will be changed to the American Wiremold Company, and it will concentrate upon the manufacture of "Wiremold" surface raceway and "Wireduct" non-metallic tubing at Hartford, Conn., where the company has taken over the plant of the Franklin Lamp Works. H B. Kirkland, vice-president, will divide his time between the Sprague Works in New York City and the American Wiremold Company at Hartford.

NEW ROBBINS & MYERS PLANT.—With capacity for about 400 employees, the Robbins & Myers Company's branch factory at Xenia, Ohio, has been placed in operation. The new plant consists of buildings leased from the Aetna Explosives Company. The plant is under the supervision of L. W. McIntire. A corps of instructors from the Springfield plant will be employed at Xenia later. The first work at the Xenia plant will consist of alternating-current stator winding.

Supply Jobbers' Notes

JOHN BELL has become connected with the Indianapolis branch of the Varney Electrical Supply Company, Indianapolis, Ind., and will cover eastern Illinois and a portion of western Indiana for this company. Mr. Bell was with the Electrical Appliance Company of Chicago for eleven years.

H. C. HANCOCK, who has represented the Trumbull Electric Manufacturing Company at its Chicago branch for several years in the Middle West States, has severed his connection to become industrial engineer with the Great Lakes Electric Company of Detroit, which is operating an extensive electrical supply jobbing business in the State of Michigan.

THE COMMERCIAL ELECTRICAL SUPPLY COMPANY, Broadway and Spruce Street, St. Louis, Mo., announces the opening of new quarters at the above address as of Aug. 1. The new building, which is 114 ft. on Broadway and 118 ft. on Spruce Street, consists of five stories and basement with a floor area of approximately 75,000 sq. ft., more than double the space of its former quarters, and permits the entire stock of the company to be consolidated under a single roof, besides providing ample room for the enlargement of the rapidly increasing demands of its customers. The organization maintains separate and distinct departments handling electrical apparatus, lamps and specialties.

Foreign Trade Notes

THOMAS S. G. MENEZES, 12 Depot Lines, Karachi, India, desires catalogs from engineering or business firms wishing a representative in Mesopatamia. On demobilization of the Mesopatamian Expeditionary Force he intends to do business in Basrah and Bagdad.

STRASCHNOW & KUBIES, 80 Fifth Avenue, New York City, export, import and commission house, have received an inquiry concerning the following apparatus from one of their customers in Amsterdam: Various kinds of single-phase and direct-current fans, motors of fractional horsepower, both alternating-current (three-phase, 50 cycles) and direct-current, and from ½ hp. to 15 hp.; 50-cycle alternators; direct-current generators; three-phase, 50-cycle oil-cooled and air-cooled transformers; rotary converters, and motor generator sets both alternating-current and direct-current. They request some interested manufacturers' quotations f.o.b. cars New York, including strong boxing for export, stating gross and net weight and measurements to enable calculation for transportation charges. Payments will be made against shipping documents on confirmed banker's credit in New York.

Trade Publications

REFLECTORS.—The Vitreous Enameling Company of Cleveland, Ohio, is issuing an illustrated leaflet describing its R. L. M. standard industrial lighting reflectors.

BLOW-OFF VALVES.—The Yarway seatless blow-off valve is the subject of a folder which the Yarnall-Waring Company of Chestnut Hill, Pa., has issued.

MAGNETIC HEATERS.—The Cushman Company of Barre, Vt., has issued a folder which illustrates its magnetic heater for use with air compressors of surface stonecutters.

WATT-HOUR METERS.—The Roller-Smith Company, 233 Broadway, New York City, has revised bulletin sheet No. 96, which covers its Columbia switchboard-type induction watt-hour meters.

SIRENS.—The Inter-State Machine Products Company, Rochester, N. Y., has issued a folder telling about its type F Sterling motor-driven alarm siren. This folder is known as bulletin No. 503.

LIGHTING PLANTS.—The Buda-Ross steam turbo-generator electric light plant is the subject of a booklet which has recently been issued by the Buda Company, Railway Exchange Building, Chicago.

FITTINGS.—J. C. Phelps, Springfield, Mass., has issued a folder telling about his J. C. P. caplets, type AB, which are being distributed by the Arco Electric Company, 114 West Forty-second Street, New York City.

LUBRICATING-OIL STORAGE SYSTEM.—S. F. Bowser & Company of Fort Wayne, Ind., have issued bulletin figure 64, which describes and illustrates their figure 64 battery unit storage system for lubricating oils.

MOTORS.—Bulletin No. 3179 has been published by the Emerson Electric Manufacturing Company of St. Louis, Mo., to replace bulletin No. 3177 and to describe its repulsion-start types "I-R" single-phase induction motors.

BOILER-ROOM INSTRUMENTS.—The Yarnall-Waring Company, Philadelphia, has just issued a 24-page booklet entitled "Boiler Room Records and the Yarway-Lea V-Notch Meter." It shows boiler-room installations and cost data.

SOCKETS.—"Harmony in Fixtures" is the title of a folder recently issued by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., telling about its porcelain sockets, which harmonize with white fixtures for bathrooms and washrooms.

New Incorporations

THE EAST MILAN LIGHT & POWER COMPANY of Milan, Ohio, has been incorporated with a capital stock of $2,000 by John Hunsdorf and others.

THE SCHROON LAKE (N. Y.) LIGHTING CORPORATION has been incorporated with a capital stock of $30,000 by M. C. Stanton, B. F. Stetson and R. B. Dudley of Elizabethtown.

THE SOUTH KOSSUTH ELECTRIC COMPANY of Livermore, Iowa, has been incorporated with a capital stock of $10,000. The officers are: Frank Hoffman, president; Peter Bormann, secretary, and John Geishecker, treasurer.

THE NORTHERN CAYUGA LIGHT & POWER CORPORATION of Oswego, N. Y., has been incorporated by C. E. Dudley, Frank Longley and James D. Bloomfield of Meridian, N. Y. The company is capitalized at $50,000 and purposes to supply electricity in Cato, Ira, Conquest, Victory, Sterling, Wolcott, Butler, Lysander, Hannibal and other towns.